FLIGHT ASSIGNMENT:

A.T.P.™

(Airline Transport Pilot)

Pilot's Operating Handbook
&
Commercial Aircraft Flight Manual

■ **IBM/Tandy/Compatibles**

the Computer Flight people

subLOGIC®

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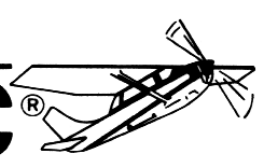

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Introduction

During the development of Microsoft® Flight Simulator® Version 3, SubLOGIC's primary engineering focus was concentrated on advancing the simulation technology and enhancing program depth. Many new features were added to the simulation throughout its development simply because the new technologies allowed us to implement them.

Flight Assignment: A.T.P. continues to advance the state of the art in microcomputer flight simulation, not just for technology's sake but as a means of achieving our goal of creating the most sophisticated, realistic flight simulation program possible. Predefined program performance specs and feature requirements allowed us to concentrate our efforts on developing the new technologies required to meet those goals.

Microsoft® Flight Simulator® was developed by innovative software engineers with little true interest in aviation. In contrast, Flight Assignment: A.T.P. is the crowning achievement of a dedicated group of genuine flying enthusiasts who have spent the better part of the past two years "earning their wings". Despite this devotion to aviation, Flight Assignment: A.T.P. is geared as much toward the novice pilot as it is to the dedicated flight simulation pro. Many thousands of hours of creativity, ingenuity and enthusiasm went into creating this commercial aircraft flight simulator. We think you'll enjoy the results!

New Features

Simulation Goals

- Commercial jet airliner simulation
- Structured flight assignments
- Challenging to experienced pilots, not overwhelming for beginning users

Simulation Improvements

- Beginner to expert flight modes
- Improved keyboard control layouts
- New fast-access, intuitive menu structures
- Improved joystick/yoke flight control interface

Scenery Improvements

- Regional ground texturing
- User-selectable scenery complexity levels
- Automatic scenery complexity selection based on machine speed
- User-selectable cross-section of scenery details
- Three scenery masks (user-adjustable) for:
  a) cruise - all scenery enabled
  b) maneuver - less scenery, faster frame rate
  c) final approach - complex runway scenery only, fastest frame rate
- 40 tallest buildings and 20 tallest transmitter towers in 26 major cities
- 26 major airports with taxiways, terminal buildings, and instrument approaches
- Over 330 other airports with correct approach lights, VASIs, auxiliary lighting, runway markings to FAA specs
- Extensive rivers, lakes, coastlines, interstates, four mountain ranges
- High-altitude scenery above 10,000 feet
- Enhanced Scenery Disk displays

Nav Radios and Nav-Aids

- Aircraft avionics include NAV, ILS, DME, ADF, RMI, IRS, radio altimeter, autopilot, and color weather radar
- Over 400 precisely-placed VOR and NDB nav-aids
- Multiple ILSs with DME to DME transmitters
- Accurate DME slant-range readings

New Features (continued)

Other Features

- Large-aircraft flight controls, including spoilers and thrust reversers
- Automatic routing via radar vectors
- Intelligent Air Traffic Control
- Multi-function autopilot flight controls
- User-specifiable waypoints and IRS (inertial reference system) tracking
- Aircraft positioning using true Latitude/Longitude coordinates (or SubLOGIC-standard North/East coordinates)
- Automatic weather system generation
- Accurate sunrise/sunset times based on date
- Permanent day, dusk, and night flight modes
- 16X time acceleration for long duration flights
- New, more accurate flight equations for five different aircraft
- Multiple accurate instrument panels for each jet transport aircraft
- Dedicated basic pitch attitude flight lessons
- User-specifiable scenery file paths

1 Running Flight Assignment: A.T.P.

This chapter describes how to install and run the Flight Assignment: A.T.P. program on your computer system, how to exit the program, and how to modify the CONFIG.ATP file to suit your system configuration requirements.

System Requirements

You will need the following minimum equipment/software to run the ATP program:

- IBM Personal Computer, XT, AT, PS/1, PS/2 or compatible
- 512K minimum memory
- Two 5-1/4" floppy disk drives (double-sided, low- or high-density),
  or
  One 3-1/2" floppy disk drive (double-sided, low- or high-density),
  or
  Single floppy disk drive (5-1/4" or 3-1/2") and hard disk drive
- VGA/EGA/CGA or Hercules Monochrome Graphics Card
- Appropriate RGB, composite, or monochrome monitor for your graphics adapter
- PC-DOS or MS-DOS (version 2.0 or newer)

Optional equipment includes:

- Mouse
- One or two joysticks and a Game Control Adapter Card
- SubLOGIC Flight Controls I with Game Control Adapter Card

The ATP program is contained on the disks you received in this package. There are no hidden files or copy protection on the program disks.

Setting Up the DOS Environment

It may be necessary for you to modify the CONFIG.SYS file (used to configure your system) so that the ATP program will operate correctly. The "FILES=??" parameter in the CONFIG.SYS file must be set to FILES=20 (or greater) to allow ATP to open 20 files concurrently. Please refer to your DOS Reference Manual for instructions on how to create and/or modify the CONFIG.SYS file as required.

Using a Floppy Disk System

IMPORTANT NOTE: You should make backup copies of the disks included in this package before attempting to load and run the ATP program. Do this by copying all the files on each master disk onto newly-formatted backup disks. Safely store the master disks, and use the backup disks to run ATP.

Starting ATP from Floppy Disk

1. Start PC-DOS or MS-DOS.
2. Insert ATP program disk 1 into drive A.
3. Type A: and press [Enter] to log onto drive A.
4. Type ATP and press [Enter] to load and run ATP.
5. ATP will prompt you to insert the other program disks as required. Insert the appropriate disk into the specified drive when prompted, and press [Enter] to continue.

When using two 5-1/4" floppy disk drives, the ATP program looks for disks 1, 2 and 3 in drive A and disk 4 in drive B. You can leave disk 4 in drive B, and insert disks 1, 2 and 3 in drive A as prompted.

The 3-1/2" disk version of the program incorporates both (5-1/4") disk 1 and disk 2 files on ATP program disk 1, and (5-1/4") disk 3 and 4 files on ATP program disk 2. You can run the ATP program solely from 3-1/2" floppy disk drive A by following the prompts and switching disks as required. If you have two 3-1/2" floppy disk drives, you can run the program solely from *either* drive A *or* drive B.

Using a Hard Disk System

ATP loads much faster and is much more convenient to run from a hard disk drive. Use the following procedure to install the program on your hard disk drive.

Installing ATP on Hard Disk

1. Start PC-DOS or MS-DOS.
2. Insert ATP program disk 1 into drive A.
3. Log onto the hard disk drive on which you want the ATP program to reside. For example, to log onto hard drive C, type C: and press [Enter].
4. Type CD\ and press [Enter] to go to the root directory.
5. Type MD ATP and press [Enter] to make a subdirectory for ATP.
6. Type CD ATP and press [Enter] to change directories.
7. Type COPY A:\ and press [Enter] to copy all ATP files from the disk in drive A to the hard disk drive.
8. Repeat step 7 for the remaining ATP program disks in sequence.

Starting ATP from Hard Disk

1. Start PC-DOS or MS-DOS.
2. Log onto the hard disk drive subdirectory you created for the ATP program. For example, to log onto the subdirectory called "ATP" on hard disk drive C, type C: and press [Enter] to log onto hard disk drive C, then type CD ATP and press [Enter] to change directories.
3. Type ATP and press [Enter] to load and run ATP.

Self-Running Demonstration Program

Flight Assignment: A.T.P. starts out by running a prerecorded demonstration program after the program has loaded. Press [Esc] to exit the sample flight assignment demo and place the aircraft on runway 14L at O'Hare International Airport in Chicago.

Exiting from ATP

There are several ways to exit from ATP. Use whichever method you prefer:

- Press [Alt][X] (when you are in flight mode with no menus showing),
  or
- Select the Flight Modes menu (press [F1]) and choose option 7, Quit,
  or
- Press [Ctrl][Break] any time.

CONFIG.ATP File Modifications

The CONFIG.ATP file in the ATP subdirectory can be modifed to custom-tailor the simulation to your system configuration. The CONFIG.ATP file is initially set to the following parameters:

```
display=auto
mouse=auto
sound=pcspkr
scenery=\scenery
stick=stick
keyboard=auto
```

You can use any ASCII text editor program to modify the CONFIG.ATP file as necessary — Brief, Pmate, etc., or the EDLIN line editor provided with DOS. (The DOS Reference Manual describes how to use the EDLIN line editor.) We do not recommend using a word processing program (WordPerfect, Microsoft Write, etc.) to edit CONFIG.ATP, since these programs can insert unwanted formatting commands or control characters into the file. Use your text editor program to modify these lines as indicated to adjust the simulation in the following ways:

display =	auto	Automatic selection of display driver.
	ega	EGA/VGA 640x350 high-res monitors, 16-color.
	egb	EGA 320x200 16-color.
	mcga	MCGA, VGA 320x200 256-color.
	cga	CGA 320x200 4-color.
	herc	Hercules, EGA monochrome 640x350.
	tandy	Tandy 1000 320x200 16-color.
mouse =	auto	Automatic mouse driver detect and use if present.
	no	Do not use the mouse driver.
sound =	pcspkr	Use PC speaker for sound generation.
	adlib	Use AdLib sound board for sound generation.
scenery =	\(subdirectory)	You may want to store your scenery files in a separate subdirectory on your hard drive. (Scenery files are created from optional SubLOGIC Scenery Disks as described in Chapter 19.) If your scenery files are located in a different subdirectory than ATP, you will have to modify this line so that the program can find and load the scenery. (For example, if the scenery files are located in a separate subdirectory called SCENERY, change this line to read scenery=\scenery.)
stick =	stick	Use joystick driver.
keyboard =	auto	Automatic selection of keyboard driver.
	ibm	Standard IBM (or Tandy Enhanced) keyboard.
	tandy	Standard Tandy 1000 keyboard.

2 A Quick Test Flight

The following steps are presented to get you flying as quickly as possible. This procedure gives you an idea of what the ATP simulation is all about and satisfies the natural desire to take the Boeing 737 out for its first flight without having to read the manual and learn all of the appropriate keyboard controls.

To begin the sample flight, load and run the ATP program and perform the following steps in sequence:

1. Press [Esc] to exit the demo program and place your aircraft at the starting location in normal flight mode. Press [F3] to turn on the Environment menu, then press the keyboard [2] key to set the day light control option to DAY mode. Press [space bar] to exit the menu and return to normal flight mode.

2. You are sitting on runway 14L at Chicago-O'Hare International Airport, and Chicago is visible in the distance. Press [Alt][>] two times to increase the complexity level of the scenery displayed in the cockpit forward view. Scenery complexity level can be adjusted to improve either the frame rate or the visual display as desired.

3. Hold down the [Shift] key and press the [Caps Lock] key to view your Boeing 737 aircraft from O'Hare control tower. Press [Shift][Caps Lock] again to see the Boeing 737 from a closer (spot plane) perspective. Finally, press [Shift][Caps Lock] again to return to cockpit forward view.

4. Press the [backspace] key to set takeoff thrust. The aircraft will begin moving rapidly down the runway and you will see the runway markings moving underneath you at an increasing rate of speed. Monitor the airspeed indicator in the upper left corner of the instrument panel and watch the moving airspeed needle. When the needle reaches the airspeed "bug" (the yellow diamond on the instrument), press the keypad [2] key two times in rapid succession. This applies a slight bit of up elevator, causing the aircraft to liftoff from the runway.

5. The natural horizon (the line where the blue sky meets the ground) will begin to drop in the cockpit view as your aircraft noses up. Press the keypad [8] key three times to apply down elevator before the horizon disappears from view. Let the aircraft fly for several seconds to stabilize itself, then press the [P] key to pause the simulation. You can press this key any time to stop the aircraft in mid-flight and think about what you want to do next. The [P] key toggles the pause feature on and off.

   In a real takeoff, you would raise the landing gear immediately after establishing positive climb, begin retracting flaps as necessary and reduce to climb thrust at

240 knots indicated airspeed. These procedures will be covered later, since the aircraft can perform adequately in takeoff configuration for purposes of this demonstration.

6. Hold down the [Shift] key and press the keypad [7] key to select the left front view. (The [Shift] key is used to make all view selections and adjustments.) You can see Chicago and Lake Michigan in the distance. While still holding the [Shift] key, press the keypad [4] key to select left view, then press [Shift][1] to select left rear view. You can see the front of the engine and the wing extending beyond it. The keypad keys are used in conjunction with the [Shift] key to select a view direction. Try them for yourself. [Shift][2] provides an unrealistic rearward view, and [Shift][5] lets you look straight down. When you're through looking around, press [Shift][8] to return to cockpit forward view.

7. Press [P] to unpause the simulation and continue your flight. While the aircraft is flying, press the [tab] key to turn on the secondary instrument panel. This panel, when selected, takes the place of the primary (first) instrument panel. The secondary instrument panel includes engine monitoring instruments, the color weather radar display, and other less-often-used gauges and indicators. Take a look at the workings of the secondary instruments, the press [tab] again to return to the primary instrument panel.

8. Quickly press and release the keypad [4] key to start banking the aircraft to the left, then press the keypad [5] key about six or seven seconds later to hold a shallow bank angle. When the city of Chicago nears the center of the cockpit forward view, press and release the keypad [6] key to start banking to the right to level your wings. Press the keypad [5] key when the aircraft is level. Use shallow left and right banks to get yourself on a level flight heading towards Chicago.

9. Press [F3] to select the Environment menu, then press the keyboard [2] key one time to select the DUSK flying environment. Press [space bar] to exit the menu and see what Chicago looks like at dusk. Press [F3], then keyboard [2], then [space bar] again to view the city of Chicago at night. City buildings are lit up at night, and many rows of city street lights are visible. Press [F3], then press the keyboard [2] key two more times followed by [space bar] to return to a normal daylight view.

10. Press the keypad [8] key three times to pitch down slightly and head directly for the Chicago city buildings. See what the individual buildings look like in closeup. Finally, hold down the [Alt] and [Ctrl] keys and press the keyboard [0] key to return the aircraft to O'Hare runway 14L. You are now back where you started.

This simple test flight offers only a small glimpse of the wide variety of simulation features and options included with the ATP program. Move on to the next page to begin your introduction to the world of commercial transport aviation.

3 The 3D Window and Instrument Panels

The Flight Assignment: A.T.P. screen display is split horizontally into two sections. The top portion of the screen display provides a 3D out-the-window view from the aircraft flight deck, while the lower portion shows the primary instrument panel for the Boeing 737, the default aircraft that is selected when you load and run the ATP program.

Figure 3.1 shows the basic screen display on an IBM/compatible system in high-resolution EGA 640x350 display mode. Lower-resolution display modes do not show the 3D out-the-window view and individual instruments in as much detail, and may substitute digital readouts for some of the instruments, but the instruments remain functionally equivalent no matter what graphics adapter/display monitor configuration you use.

Large commercial transport aircraft require much more instrumentation than that found on a small single-engine airplane. In the case of ATP, many of the less-often-used instruments, indicators and warning lights have been placed on a secondary instrument panel that is not visible when the primary instrument panel is displayed. Press the [tab] key to toggle between primary and secondary instrument panel displays. The secondary instrument panel, when selected, takes the place of the primary instrument panel.

This chapter describes the 3D window view, and the instruments, radios and indicators shown on both the primary and secondary B737 instrument panels.

3D Window

The top half of the ATP screen display usually shows a realistic out-the-window 3D view from the cockpit of the aircraft. After pressing [Esc] to exit the startup demo mode, the aircraft is placed on runway 14L at Chicago-O'Hare International Airport and you can see the runway and various runway markings. Cities, airports, ground terrain features, and the horizon are usually visible when flying. The view is obscured when you fly through clouds. At night, only the stars, city and airport lights are visible.

The 3D window display defaults to a cockpit forward view when you load and run the ATP program. You can look in nine different cockpit view directions, or display one of several different external views of your aircraft in the 3D window. A second 3D window and a map window may also be turned on, and you can separately adjust the types and complexity of scenery displayed in each window. Window view controls and scenery display adjustments are described in the following chapters of this manual.

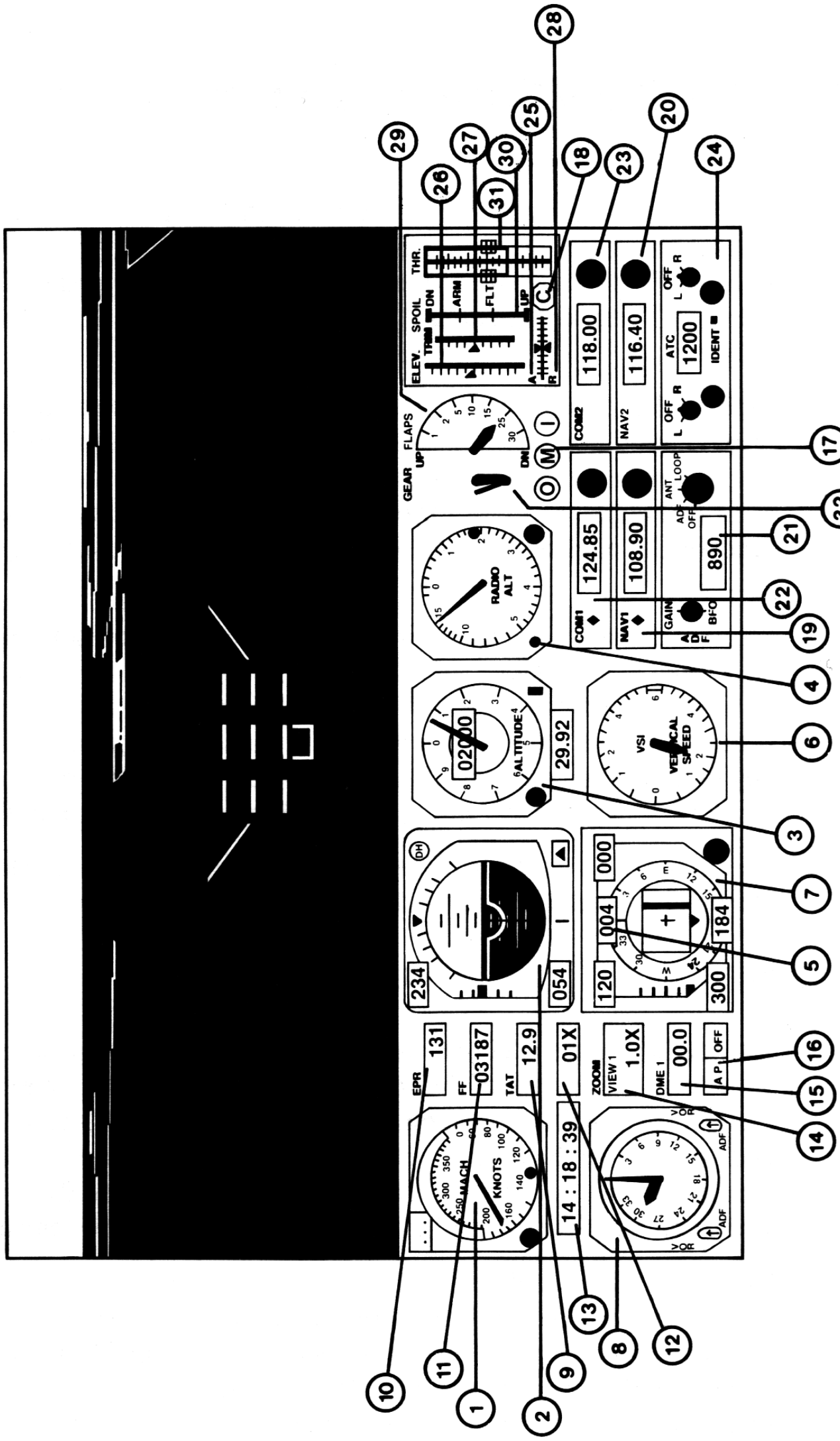


Figure 3.1. B737 Primary Instrument Panel

B737 Primary Instrument Panel

Flight Instruments and Indicators

1. Airspeed Indicator (knots)
   - Mach Indicator
   - Airspeed Bug
2. Attitude Director Indicator (ADI)
   - Artificial Horizon
   - NAV1 Course Deviation Index (CDI)
   - NAV1 Glideslope Deviation Index
   - NAV1 Omni-Bearing Selection (OBS)
   - NAV1 OBS Reciprocal Course Indicator
   - NAV1 TO-OFF-FROM Flag Indicator
3. Altimeter (feet)
   - Digital Altitude Readout
   - Barometric Pressure Indicator
4. Radio Altimeter
   - Radio Altimeter Bug
   - Decision Height Light
5. Heading Indicator
   - Reciprocal Heading Indicator
   - Heading Bug Indicator
6. Vertical Speed Indicator

Other Instruments and Indicators

7. Horizontal Situation Indicator (HSI)
   - NAV2 Course Deviation Index (CDI)
   - NAV2 Glideslope Deviation Index
   - NAV2 Omni-Bearing Selection (OBS)
   - NAV2 OBS Reciprocal Course Indicator
   - NAV2 TO Flag
   - NAV2 FROM Flag
   - NAV2 OFF Flag
8. Radio Magnetic Indicator (RMI)
   - RMI1 Needle
   - RMI1 Reference Selecter
   - RMI2 Needle
   - RMI2 Reference Selecter
9. Total Air Temperature (TAT) Indicator
10. Engine Pressure Ratio (EPR) Indicator
11. Fuel Flow (FF) Indicator
12. Time Acceleration (Speed) Indicator
13. Clock
14. Selected Window/Zoom Factor Indicator
15. Distance Measuring Equipment (DME) Indicator
16. Autopilot Status Indicator
17. Marker Beacon Lights: O(uter), M(iddle), and I(nner)
18. Configuration Warning Light

Radios

19. NAV1 Radio
20. NAV2 Radio
21. Automatic Direction Finder (ADF)
22. COM1 Radio
23. COM2 Radio
24. Transponder (XPNDR)

Aircraft Control Position Indicators

25. Aileron Position Indicator
26. Elevator Position Indicator
27. Elevator Trim Position Indicator
28. Rudder Position Indicator
29. Flaps Position Indicator
30. Spoiler Position Indicator
31. Thrust Indicator
32. Gear Position Indicator

Boeing 737 Primary Instrument Panel

The Boeing 737 primary instrument panel, when selected, occupies the lower half of the screen display as shown in Figure 3.1. Panel instruments and radios are arranged in a manner consistent with their placement in a real B737, and are displayed in the same form and style used in that aircraft. The Boeing 747/767, Airbus A320, and Shorts 360 primary instrument panels may display these instruments in different forms and/or locations, but they are functionally identical in all aircraft.

The B737 primary instrument panel includes primary flight instruments, other instruments, indicators and radios. Additional instruments and indicators are included on the secondary instrument panel. Press [tab] to toggle between the primary and secondary instrument panel displays. Primary instrument panel instrument functions and controls are described below. The number preceding each name and description corresponds with the instrument number in Figure 3.1.

Flight Instruments and Indicators

1. Airspeed Indicator: An airspeed needle indicates the aircraft's airspeed (not ground speed) through the air around it. The airspeed indicator is calibrated in knots (1 knot ≈ 1.15 miles per hour), and measures ram vs. static air pressure differences to determine indicated airspeed.

Indicated airspeed is reasonably accurate below 10,000 feet MSL (above mean sea level) at airspeeds under 180 knots. Indicated airspeed errors are magnified as you increase altitude and airspeed. At higher altitudes and airspeeds, the **mach indicator** box in the upper left corner of the airspeed indicator provides a valid indication of your airspeed expressed in terms of mach number (the ratio of true airspeed to the speed of sound, e.g., .74M).

The open diamond-shaped **airspeed bug** on the airspeed indicator may be manually adjusted to set pilot reference airspeeds (V_1, V_R, V_2, etc.). Press [Shift][;] to select the airspeed bug, then use [Shift][=] or [Shift][-] to make coarse increase or decrease adjustments, and [Shift][right bracket] or [Shift][left bracket] to finely increase or decrease the reference airspeed setting.

2. Attitude Director Indicator (ADI): This instrument combines the functions of an attitude indicator with the approach, landing, and general navigation functions coupled to the NAV1 radio.

The **artificial horizon** (attitude indicator) shows the pitch and bank attitudes of your aircraft in relation to the natural horizon. When the center horizon bar is aligned with the artificial horizon, you are in straight and level flight. Horizontal markings above and below the artificial horizon indicate nose-up and nose-down pitch angles. Each horizontal line represents a pitch attitude increment of 2-1/2 degrees. Successive lines

indicate a pitch attitude of 2.5°, 5°, 7.5°, 10°, and 12.5° respectively. Bank markings at the top edge of the instrument indicate 10°, 20°, 30°, and 45° bank angles. A small bank indicator arrow at the top of the artificial horizon moves and points to the bank marks to indicate the current aircraft bank attitude.

The ADI is also used to perform navigation functions in conjunction with the NAV1 radio. The NAV1 radio can be tuned to a VOR (Very high frequency Omnidirectional Range) or a runway ILS localizer frequency. When NAV1 is tuned to a VOR, this instrument lets you determine what VOR radial your aircraft is on and helps you fly bearings to or radials from the VOR station. Localizer frequencies are used to facilitate instrument approaches to runways. (See the "Navigation" section of Chapter 8 for instructions on how to use this instrument.)

The **course deviation index (CDI)** is located directly below the artificial horizon. A vertical CDI needle shows your deviation from the VOR course (selected in the OBS box) or the localizer course tuned in the NAV1 radio.

The **glideslope deviation index** is located directly to the left of the artificial horizon. A horizontal glideslope deviation index needle shows your vertical deviation from the electronic glidepath. The electronic glidepath and localizer (tuned in the NAV1 radio) are components of an ILS approach.

When NAV1 is tuned to a VOR, the **omni-bearing selection (OBS)** box in the upper left corner of the ADI is used to determine the radial your aircraft is on, or to select the bearing or radial on which you want to fly. Press [Shift][1] to reference the NAV1 radio, then use [Shift][0] to increase or [Shift][9] to decrease the OBS setting.

The **OBS reciprocal course indicator** box in the lower left corner of the ADI shows the reciprocal of the course selected in the NAV1 OBS box.

The **TO-OFF-FROM flag indicator** box in the lower right corner of the ADI shows whether you are on the course shown in the OBS or on a 180° opposite course. When the upward-pointing TO flag is displayed, the CDI needle shows your deviation from a bearing when flying toward a VOR station. When the downward-pointing FROM flag is displayed, the CDI needle shows your deviation from a radial when flying away from a VOR station. The OFF flag may be displayed during station passage, if the signal is too weak or your radio fails, or if you incorrectly tune the VOR frequency on the NAV1 radio.

3. Altimeter: This instrument measures your altitude in feet above sea level, and is operated by atmospheric pressure. The needle sweeps around the face of the the instrument to indicate altitude in 100-foot increments, while the **digital altitude readout** in the center of the altimeter lists your altitude in feet above sea level to the nearest hundred feet.

Barometric pressure changes can cause changes in the altimeter reading. You must periodically reset the altimeter to the current barometric pressure of the area through which you are flying. Press [Shift][<] to decrease or [Shift][>] to increase the barometric pressure setting in the **barometric pressure indicator** box directly beneath the altimeter. At altitudes above 18,000 feet MSL (mean sea level), you must set the altimeter to the standard barometric pressure setting of 29.92" of mercury.

4. Radio Altimeter: The low range radio altimeter indicates absolute AGL altitude up to a maximum altitude of 1500 feet, and provides signals to the autopilot and the decision height (DH) light.

The open diamond-shaped **radio altimeter bug** on the radio altimeter may be manually adjusted to set a decision height for a runway landing approach. Press [Shift]['] to select the radio altimeter bug, then use [Shift][=] or [Shift][-] to make coarse increase or decrease adjustments, and [Shift][right bracket] or [Shift][left bracket] to finely increase or decrease the decision height setting.

The **decision height (DH) light** in the upper right corner of the ADI (see Figure 3.1, item 2) is triggered by the radio altimeter bug setting. The DH light is turned off when you are above the specified decision height. The DH light turns green when you reach the decision height altitude set by the radio altimeter bug, and it turns red when you drop fifty feet below the specified decision height.

5. Heading Indicator: The heading indicator box in the top center of the horizontal situation indicator (HSI) (Figure 3.1, item 7) indicates your direction of flight, as referenced to the magnetic compass. The heading indicator is a gyroscopically-controlled compass that is not affected by the factors that induce errors in a magnetic compass.

The **reciprocal heading indicator** box in the bottom center of the HSI provides a 180° opposite heading indication.

The **heading bug indicator** box in the upper right corner of the HSI is used to set a target heading for the autopilot to follow, or to set a pilot reference heading. Press [Shift][8] to select the heading bug indicator. Use [Shift][=] or [Shift][-] to quickly increase or decrease the heading bug indicator setting in 10° increments, and use [Shift][right bracket] or [Shift][left bracket] to increase or decrease the setting in one-degree increments until the target heading is reached.

6. Vertical Speed Indicator: The vertical speed indicator needle shows your rate of climb or descent in feet per minute. The instrument is calibrated in 1000-foot increments. The needle rises or drops to indicate the rate of climb or descent, and indicates a zero rate of climb/descent when centered on zero. This instrument measures the rate of air pressure change, and is not affected by absolute barometric pressure.

Other Instruments and Indicators

7. Horizontal Situation Indicator (HSI): This instrument performs the same general navigation, approach, and landing functions as the ADI (item 2), but is coupled to the NAV2 radio.

Components of the HSI include a **course deviation index (CDI)** box located in the center of the instrument, and a **glideslope deviation index** on the left side of the HSI. These components function just as they do on the ADI. The vertical CDI needle shows deviation from a VOR or localizer course tuned in the NAV2 radio, while the glideslope deviation index needle shows vertical deviation from a glidepath.

When NAV2 is tuned to a VOR, the **omni-bearing selection (OBS)** box in the upper left corner and the **OBS reciprocal course indicator** box in the lower left corner of the HSI perform the same functions as their ADI counterparts. Press [Shift][2] to reference the NAV2 radio, then use [Shift][0] or [Shift][9] to increase or decrease the OBS setting.

The HSI **TO**, **FROM**, and **OFF flags** also function in the same way as on the ADI. The upward-pointing TO flag is displayed above the CDI box, the downward-pointing FROM flag below the CDI box, and the OFF flag inside the CDI box.

8. Radio Magnetic Indicator (RMI): The RMI is used to determine the bearing to two different VOR stations, or to a VOR station and a nondirectional radio beacon (NDB) relative to your heading.

The **RMI1 needle** (the thin white needle) points either to the VOR station tuned on the NAV1 radio, or to the NDB station tuned on the ADF radio. Press [Shift][6] to select the **RMI1 reference selecter** in the lower left corner of the RMI, then use [Shift][=] or [Shift][-] to toggle between the VOR (NAV1) or ADF position. The RMI1 reference selecter indicates which radio is selected, and the RMI1 needle points to the relative bearing of the selected nav-station. On program startup the RMI1 reference selector is set to the ADF position.

The **RMI2 needle** (the thick yellow needle) and **RMI2 reference selecter** function in exactly the same way, except that the RMI2 needle points to the VOR station tuned on the NAV2 radio when VOR position is selected. Press [Shift][7] to select the RMI2 reference selecter in the lower right corner of the RMI, then use [Shift][=] or [Shift][-] to toggle between VOR (NAV2) and ADF. On program startup the RMI2 reference selector is set to VOR (NAV2) position.

9. Total Air Temperature (TAT) Indicator: Displays temperature indications from an externally-mounted TAT probe. The TAT indication is comprised of outside air temperature plus all of the ram rise. At higher airspeeds the TAT indication will be much higher than actual outside static air temperature.

10. Engine Pressure Ratio (EPR) Indicator: Indicates the ratio of turbine discharge pressure to compressor inlet pressure for engine #1 (left engine).

11. Fuel Flow (FF) Indicator: Indicates individual engine fuel consumption rate in pounds per hour.

12. Time Acceleration (Speed) Indicator: The ATP program lets you accelerate the rate at which time passes, up to a maximum of 16X normal speed (see Chapter 9). This indicator shows the current time acceleration factor in effect, from 1X (normal speed) to 16X.

13. Clock: This is a standard digital clock that measures hours, minutes and seconds, and displays time in a 24-hour format. Simulation time is automatically set to your system clock setting on program loadup. See Chapter 12 for instructions on how to adjust and/or reset time as desired.

14. Selected Window/Zoom Factor Indicator: Indicates the zoom factor in effect for the currently selected 3D window.

15. Distance Measuring Equipment (DME) Indicator: The DME indicator works in conjunction with the NAV1 and NAV2 radios to tell you how many nautical miles you are from the tuned VOR or ILS localizer transmitter (when DME is available; most VOR stations and many ILS stations also transmit DME information). Press [Shift][3] to select the DME indicator. Press [Shift][=] to cycle forward from DME1 (distance to the NAV1-tuned station), to DME2 (NAV2-tuned station distance), to HOLD2. Hold is used to hold the transmitter-distance display when tuning the referenced NAV radio to a different frequency. Press [Shift][-] to cycle backwards from DME2 to DME1 to HOLD1.

16. Autopilot Status Indicator: Indicates whether the autopilot is currently turned on or off.

17. O(uter), M(iddle), and I(nner) Marker Beacon Lights: These lights are activated in sequence to indicate when your aircraft is over the outer, middle, and inner marker beacons during an airport runway instrument landing approach.

18. Configuration Warning Light: This light flashes red and emits a low-pitched warning tone at five-second intervals when the simulation determines that the landing gear, flaps, and/or spoilers are incorrectly positioned for your current flight requirements. The configuration warning light and audible warning signal are activated under the following conditions: airspeed below 135 kts and landing gear not extended, gear or flaps extended at too high an airspeed, flaps extended beyond the maximum recommended takeoff setting at climb (or greater) thrust levels, or spoilers extended at thrust levels in excess of 20%.

Radios

19. NAV1 Radio: This is a 200-channel radio that receives frequencies between 108.00 and 117.95 megahertz (MHz) with 50 kilohertz (kHz) separation. The NAV1 radio is used to tune in and identify a VOR or localizer frequency, and controls the navigation functions of the ADI instrument (item 2) and the RMI1 needle (item 8) when the RMI1 reference selecter is set to the VOR position.

Press [Shift][1] to select the NAV1 radio. Use [Shift][=] or [Shift][-] to increase or decrease the full megahertz frequency value tuned on the NAV1 radio, and use [Shift][right bracket] or [Shift][left bracket] to increase or decrease the fractional frequency value. When you've tuned the NAV1 radio to the correct VOR or localizer frequency, press [Shift][I] to hear an audible identification code for the tuned navigation station. The ident code confirms that you've correctly tuned the nav-station on the NAV1 radio, and that the station is transmitting correctly. Press [Shift][O] to turn off the ident code. A running ident code will continue until completed.

20. NAV2 Radio: A second NAV radio is provided so that you can simultaneously tune two VORs and crosscheck your position. The NAV2 radio is functionally equivalent to the NAV1 radio, but controls the HSI (item 7) navigation functions and the RMI2 needle (item 8) when the RMI2 reference selecter is set to VOR position.

Press [Shift][2] to select the NAV2 radio, use [Shift][=] or [Shift][-] to increase or decrease the full megahertz frequency value, and use [Shift][right bracket] or [Shift][left bracket] to increase or decrease the fractional frequency value. Use [Shift][I] and [Shift][O] to turn the tuned navigation station identification code on and off.

21. Automatic Direction Finder (ADF): This is a navigation radio that receives frequencies from 200kHz to 999kHz in 1kHz increments. The ADF is used to tune non-directional radio beacons (NDBs). Either RMI needle (RMI1 or RMI2) may be used to determine relative bearing to the tuned NDB by setting the appropriate RMI reference selecter to the ADF position.

Press [Shift][4] to select the ADF radio. Use [Shift][=] or [Shift][-] to increase or decrease the most-significant-digits frequency value, and use [Shift][right bracket] or [Shift][left bracket] to increase or decrease the least-significant-digits frequency value on the ADF radio.

22. COM1 Radio: A 360-channel transceiver that receives and transmits at frequencies between 118.00 and 135.95 MHz with 50 kHz separation. This radio is used to communicate with ATIS (Automatic Terminal Information Service), clearance delivery, ground control, the control tower, approach/departure control, and ATC (Air Traffic Control) centers.

Press [Ctrl][1] to select the COM1 radio. Use [Ctrl][=] or [Ctrl][-] to increase or decrease the full megahertz frequency value tuned on the COM1 radio, and use [Ctrl][right bracket] or [Ctrl][left bracket] to increase or decrease the fractional frequency value.

23. COM2 Radio: A second COM radio is provided for backup purposes in case of COM1 failure. The COM2 radio also may be tuned ahead of time (if you know the correct frequency) in anticipation of being transferred to another control facility. The COM2 radio is functionally equivalent to the COM1 radio.

Press [Ctrl][2] to select the COM2 radio. Use [Ctrl][=] or [Ctrl][-] to increase or decrease the full megahertz frequency value, and use [Ctrl][right bracket] or [Ctrl][left bracket] to increase or decrease the fractional frequency value.

24. Transponder: Electronic equipment used to identify your aircraft, flight number, altitude, and unique 4-digit transponder "squawk" code on the Air Traffic Control radar screen. Press [Ctrl][3] to select the transponder, then use [Ctrl][=] or [Ctrl][-] to increase or decrease the most-significant-digits, and use [Ctrl][right bracket] or [Ctrl][left bracket] to increase or decrease the least-significant-digits setting on the transponder.

Aircraft Control Position Indicators

25. Aileron Position Indicator: Indicates the current position of the alierons. The ailerons are centered when the arrow on the indicator is aligned with the raised center mark. When left aileron is applied, the arrow points to the left of center and the aircraft rolls to the left. When right aileron is applied, the arrow points to the right of center and the aircraft rolls to the right.

26. Elevator Position Indicator: Indicates the current elevator position. When the arrow on the indicator is aligned with the raised center mark, the elevator is neutral. When the arrow points above the center mark, the elevator is raised. When the arrow is below the center mark, the elevator is lowered.

27. Elevator Trim Position Indicator: Indicates the current elevator trim tab setting.

28. Rudder Position Indicator: Indicates the current rudder position. The rudder is centered when the arrow on the indicator is aligned with the raised center mark. When left rudder is applied, the arrow points to the left of center and the aircraft yaws to the left. When right rudder is applied, the arrow points to the right of center and the aircraft yaws to the right. When the auto-coordination option is turned on, the program applies rudder for you automatically, and the aileron and rudder position indicator arrows move as a single unit.

29. Flaps Position Indicator: Indicates the current position of the flaps. Nine different flap settings may be selected on the Boeing 737, from full up (retracted) to full down (fully deployed at 40°).

30. Spoiler Position Indicator: Indicates the position of the spoilers; down (retracted), armed (set to deploy automatically on touchdown when reverse thrust is applied), flight position (used to increase your descent rate), or up (fully deployed to help bring the aircraft to a stop after a touchdown).

31. Thrust Indicator: Indicates the current thrust lever setting, from full thrust (indicator boxes all the way up) to full reverse thrust (indicator boxes all the way down).

32. Gear Position Indicator: Indicates whether the landing gear is down (extended) or up (retracted).

Boeing 737 Secondary Instrument Panel

The B737 secondary instrument panel, when selected, occupies the lower half of the screen display as shown in Figure 3.2. This instrument panel includes fuel and engine monitoring instruments, other instruments, indicators, and the color weather radar display. The form and location of these instruments varies by aircraft.

Press [tab] to turn on the secondary instrument panel. The [tab] key is used to toggle between the primary and secondary instrument panel displays. Secondary instrument panel instruments and indicators are described below. The number preceding each name and description corresponds with the instrument number in Figure 3.2.

Engine Monitoring Instruments

33, 34, & 35. Fuel Tank Fuel Quantity Gauges: Three gauges indicate the quantity of usable fuel remaining in the left wing fuel tank, right wing fuel tank, and reserve fuel tank.

36 & 37. Engine #1 & #2 N_1 RPM Indicators: Two self-powered gauges indicate the low pressure compressor speed in percent of RPM for engine #1 (left engine) and engine #2 (right engine).

38 & 39. Engine #1 & #2 Engine Pressure Ratio (EPR) Indicators: Two gauges indicate the ratio of turbine discharge pressure to compressor inlet pressure for engine #1 (left engine) and engine #2 (right engine). These are the primary thrust setting instruments on an actual Boeing 737 aircraft, since EPR varies proportionally to the developed thrust.

40 & 41. Engine #1 & #2 N_2 RPM Indicators: Two self-powered gauges indicate the high pressure compressor speed in percent of RPM for the left and right engines.

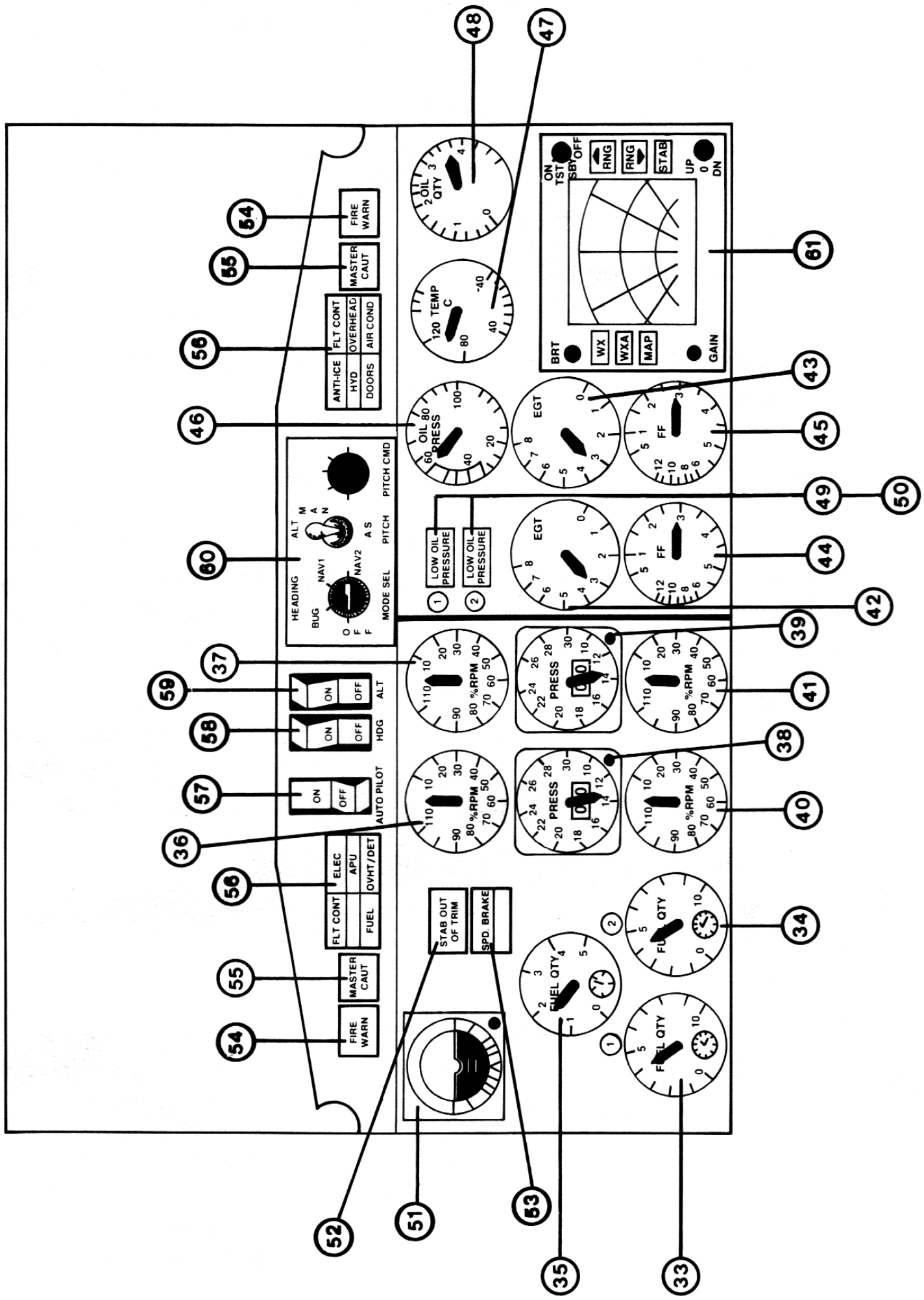


Figure 3.2. B737 Secondary Instrument Panel

B737 Secondary Instrument Panel

Engine Monitoring Instruments

33. Left Wing Fuel Tank Fuel Quantity Gauge
34. Right Wing Fuel Tank Fuel Quantity Gauge
35. Reserve Fuel Tank Fuel Quantity Gauge
36. Engine #1 N_1 RPM Indicator
37. Engine #2 N_1 RPM Indicator
38. Engine #1 Engine Pressure Ratio (EPR) Indicator
39. Engine #2 Engine Pressure Ratio (EPR) Indicator
40. Engine #1 N_2 RPM Indicator
41. Engine #2 N_2 RPM Indicator
42. Engine #1 Exhaust Gas Temperature (EGT) Indicator
43. Engine #2 Exhaust Gas Temperature (EGT) Indicator
44. Engine #1 Fuel Flow (FF) Indicator
45. Engine #2 Fuel Flow (FF) Indicator
46. Oil Pressure Indicator
47. Oil Temperature Indicator
48. Oil Quantity Indicator
49. Engine #1 Low Oil Pressure Light
50. Engine #2 Low Oil Pressure Light

Other Instruments and Indicators

51. Standby Attitude Indicator
52. Stabilizer Out of Trim Light
53. Speed Brake Light

Glare Shield

54. Fire Warning Lights
55. Master Caution Lights
56. System Annunciator Lights
57. Autopilot Master On/Off Toggle
58. Autopilot Heading On/Off Toggle
59. Autopilot Altitude On/Off Toggle
60. Autopilot Module

Weather Radar

61. Color Weather Radar Display

42 & 43. Engine #1 & #2 Exhaust Gas Temperature (EGT) Indicators: Two self-powered gauges indicate the turbine exhaust gas temperature (as sensed by thermo-couples) for the left and right engines.

44 & 45. Engine #1 & #2 Fuel Flow (FF) Indicators: Two gauges indicate fuel consumption rate in pounds per hour for the left and right engines.

46. Oil Pressure Indicator: The two needles on this gauge indicate oil pressure in the left and right engines.

47. Oil Temperature Indicator: Two needles indicate oil temperature in the left and right engines.

48. Oil Quantity Indicator: Two needles indicate engine oil quantity in gallons for the left and right engines. The engine #2 oil tank holds 1/2 gallon less oil than the #1 tank. When a needle shows zero, 1.3 gallons remain in that engine oil tank.

49 & 50. Engine #1 & #2 Low Oil Pressure Lights: Two warning lights that are illuminated to indicate an engine oil pressure below 35 psi in the left or right engine respectively.

Other Instruments and Indicators

51. Standby Attitude Indicator: A second attitude indicator is provided for backup purposes in case of ADI failure.

52. Stabilizer Out of Trim Light: Illuminated when the stabilizer is out of trim for the conditions required by the autopilot. This light is not functional in the ATP simulation.

53. Speed Brake Light: Illuminated when the speed brake is activated. This light is not functional in the ATP simulation.

Glare Shield

54. Fire Warning Lights: Both lights illuminated indicate that an engine fire warning signal has been received. These lights are not functional in the ATP simulation.

55. Master Caution Lights: Both lights illuminated indicate that a system annunciator light has illuminated. These lights are not functional in the ATP simulation.

56. System Annunciator Lights: Any one of ten system annunciator lights may be illuminated to indicate that a warning signal has been received from the indicated system. These lights are not functional in the ATP simulation.

57. Autopilot Master On/Off Toggle: The autopilot master toggle switch is used to enable/disable the autopilot. Press [Shift][Z] to toggle the autopilot master on or off.

58. Autopilot Heading On/Off Toggle: The autopilot heading toggle switch is used to operate the autopilot in three different *heading hold* flight modes: heading bug/ NAV1/NAV2/off. When you press [Shift][X] to turn on the autopilot heading toggle switch, the autopilot follows the target heading set in the heading bug indicator box (see Figure 3.1, item 5 description) on the HSI. A second [Shift][X] keypress causes the autopilot to track the VOR station tuned on the NAV1 radio, and a third [Shift][X] keypress causes the autopilot to track the NAV2-tuned VOR station. Press [Shift][X] a fourth time to turn the autopilot heading toggle switch off and disable the heading hold component of autopilot flight control. The mode selection indicator on the autopilot module (see item 60 below) indicates which heading hold flight mode is currently in effect. (The autopilot master must be turned on in order to use this feature.)

59. Autopilot Altitude On/Off Toggle: The autopilot altitude toggle switch is used to toggle the autopilot *altitude hold* flight mode on and off. When you press [Shift][C] to turn the autopilot pitch toggle switch on, the autopilot locks the aircraft into the current altitude. You must adjust thrust for the desired airspeed. Press [Shift][C] again to turn the autopilot pitch toggle switch off and disable the altitude hold component of autopilot flight control. (The autopilot master must be turned on in order to use this feature.)

60. Autopilot Module: In a real aircraft, the autopilot module is used to select and adjust a variety of autopilot flight modes and submodes. In the ATP simulation, the heading mode selection indicator on this instrument simply indicates which heading hold flight mode is currently in effect: heading bug, NAV1, NAV2, or off.

Weather Radar

61. Color Weather Radar Display: An X-band alphanumeric digital radar is used for weather detecting and analysis. The system detects and locates various types of storms along the flight path of the aircraft, and gives the pilot a visual indication, in colors, of their intensity. Storm intensity levels are displayed in colors contrasted against a black background. Areas of heaviest rainfall appear in red, the next level of rainfall in yellow, and the least rainfall in green. The radar system performs only the function of weather detection and should not be used, nor relied upon, for proximity warning or anti-collision protection.

The color weather radar display has a range of 150 nautical miles. The three concentric range marks indicate distances of 50, 100, and 150 nautical miles respectively. When the automatic weather generation system is turned on (option 1 on the [F3] Environment menu), the color weather radar display will show any rainfall or thunderstorm activity that you should be aware of along your current flight path. When clouds are adjusted manually (option 7 on the [F3] Environment menu), the color weather radar displays thunderstorm cloud locations and intensities (red or yellow depending on the height/intensity of the thunderstorm clouds you set on the Clouds menu), and displays a full overcast cloud layer in green to indicate low-level intensity precipitation.

4 Menu Descriptions

Multiple menus give you access to a wide variety of simulation controls. Each menu lets you adjust or select from a group of related control functions.

This chapter tells you how to use menus and adjust menu options, and briefly describes each menu option. The best way to follow these descriptions is to bring up the appropriate menu and read the descriptions while the menu is displayed. Detailed menu option descriptions and adjustment instructions are provided in the following chapters of this manual.

Using Menus

The keyboard Function keys are used to bring up all ATP control and configuration menus. To select a menu, simply press the appropriate Function key for the menu you'd like to use. The [F10] Help menu lists the names of all other available menus and the Function keys used to select them.

To select a menu option, press the (keyboard) number or letter key listed before the option name, or point the mouse cursor at the option and click the left mouse button. Menu options are adjusted according to the standard conventions described below. You can move freely between the main control and configuration menus by pressing the appropriate Function keys, and adjust options on as many different menus as you like. Any menu option adjustments you make take effect as soon as you exit from the menu and return to flight mode.

Exit from a menu by pressing [Esc] or the [space bar]. [Esc] returns you to the previous menu, and [space bar] returns you directly to flight mode.

Menu Conventions

Menu options are adjusted in a variety of ways depending on the type and complexity of the simulation parameter you select:

A + symbol in front of an option (e.g. 3 + Window Titles) indicates that the option is turned on or selected. The absence of a + symbol indicates that it is off. Press the appropriate key to toggle the option on and off.

Some options cycle through a series of selections with each keypress of the option number or letter (e.g. 3 Select Current Window: 1st 3D). In this example the option cycles through 1st 3D window, 2nd 3D window, and Map view.

Other options list a specific simulation parameter (e.g. 8 Pressure: 29.92 Inches) that becomes highlighted when the option is selected. In this example, you must type a new value and press [Enter] to specify a new barometric pressure.

Finally, selecting some options opens another menu where the current simulation parameters may be adjusted or reviewed (e.g. 7 Clouds). These sub-menus are self-explanatory, and generally follow the same standard conventions as the main menus.

[F1] Flight Modes Menu

The [F1] Flight Modes menu is used to select auto flight and flight assignment modes, view demo flights or an instant replay of your flight, and exit the ATP program.

1. Free Flight: Selecting this option returns you to normal flight mode from auto flight or either flight assignment mode.

2. Auto Flight: In auto flight mode, all you have to do is specify departure and destination airports. The simulation automatically flies a pre-determined flight plan between the airports you've selected, tunes and resets the NAV and COM radios as required, and maintains contact with Air Traffic Control.

Departure and destination selection sub-menus are used to select departure and destination airports. The departure selection menu also gives you the option of selecting and watching the simulation fly any one of 96 predetermined career flight assignments. Auto flight sub-menus vary from standard menu conventions in that you must press [Esc] to continue on to the next menu, or press [space bar] to cancel your selections and return to normal flight mode.

3. Single Assignment: Select your own departure and destination airports, or choose to fly and preview any one of the 96 predetermined career flight assignments. Single flight assignment sub-menus vary from standard menu conventions in that you must press [Esc] to continue on to the next menu, or press [space bar] to abort the assignment and return to normal flight mode.

When you complete a single flight assignment, the simulation will grade your performance and give you a one-time performance rating. Single flight assignment performance ratings do not affect your career standing. The program does not record single flight assignments in a flight logbook.

4. Career Assignment: Fly a continuing series of 96 predetermined career flight assignments in sequence. The program rates your performance on each flight, and maintains a career record of your performance history as an airline transport pilot. The simulation automatically records a new entry in your flight logbook when you successfully complete a career flight assignment.

5. Demo Library: Lets you play back, rename or delete prerecorded demo programs.

6. Instant Replay: Lets you review the last few seconds of your flight.

7. Quit: Ends the aircraft flight and returns you to DOS.

[F2] Mode Library Menu

The [F2] Mode Library menu lets you select, load, create and delete flight modes. A mode is the starting point of a flight.

1. Next Hotkey Mode: This option lets you cycle through and select any one of nine hotkey modes (flight modes that may be loaded directly while flying the aircraft). A + symbol indicates the current selected hotkey mode.

2. Next Available Mode: Cycles through and selects any available flight mode. A + symbol indicates the selected flight mode. Other options on this menu allow you to load, rename or delete the selected flight mode, transfer it to a hotkey mode slot, or save it as the default startup mode.

3. More Available Modes: The [F2] Mode Library menu can only display nine flight modes at a time. Use this option to list additional available modes as necessary.

4. Set Hotkey Mode: Copies the selected flight mode to the selected hotkey mode slot (1-9). All changes are saved to disk and remain in effect the next time you restart the simulation.

5. Rename Mode: Lets you rename the selected flight mode.

6. Delete Mode: Deletes the selected flight mode from the list of available modes.

7. Create Mode: Lets you create a new flight mode with all locations, controls, and environmental conditions the way they currently are set.

8. Reset Using Mode: Brings the aircraft back to the initial conditions of the selected flight mode.

9. Save Startup Mode: Specifies the selected flight mode as the startup mode to be used the next time you restart the simulation.

A. Use Mode Sensitivities: Allows you to either use or turn off keyboard, mouse and joystick/yoke sensitivity adjustments when loading a previously saved flight mode. A + symbol indicates that the flight mode you select and load will use the same sensitivities that were in effect when the mode was created.

[F3] Environment Menu

The [F3] Environment menu lets you modify environmental factors and override the current specified environmental parameters.

1. Auto Weather: Toggles the automatic weather generation system on and off.

2. Day Light Control: Overrides the specified time of day and lets you select between a permanent day, dusk (dawn), or night flying environment. Cycle this option off to turn off the permanent time of day override.

3. Reset Time/Date: Resets the simulation to your computer system's time and date.

4. Time: Lets you adjust the time of day as desired for dawn, day, dusk or night flight.

5. Date: Lets you specify the date (month and day), then automatically selects the appropriate transition times for dawn to day, day to dusk, dusk to night, etc.. Seasonal environmental factors (weather, winds and temperature) are also adjusted appropriately.

6. Winds: Lets you set three levels of winds as well as surface winds, and specify a turbulence value for each level. Adjusting any of these last four menu options also turns off auto weather (if currently turned on).

7. Clouds: Lets you set and adjust two levels of clouds (base and tops altitudes, level of coverage, random variations to absolute cloud height) plus thunderstorm clouds (base, tops, coverage, movement direction, and speed).

8. Pressure: Lets you specify barometric pressure.

9. Temperature: Lets you specify the surface air temperature in degrees Celsius.

[F4] Views Menu

The [F4] Views menu is used to adjust external view and window display options.

1. Position Spot Plane: Lets you specify the direction, altitude and distance of the external spotter airplane view.

2. Window Orientation: Lets you adjust the sizes and positions of windows, move the instrument panels, and activate and move the optional aircraft control position indicator (see option 4, below).

3. Window Titles: Turns on/off a title (such as "COCKPIT") at the top of each window to identify the view mode. Leave this off for the highest frame rate.

4. Control Position Indicator: Turns on/off an indicator which shows the current position of the primary flight controls — ailerons, elevator, rudder and throttle. This indicator is very useful when used in conjunction with full screen external view.

5. Full Screen External View: Toggles the full screen feature on/off. In full screen mode, views from outside your aircraft cover the entire screen instead of filling only the 3D window. The instrument panel is not visible when outside views are displayed.

6. Autozoom Tower View: Toggles the tower view autozoom feature on/off. When on, the tower view zooms in and out automatically to keep your aircraft in sight no matter how near or far away you fly.

[F5] Graphics Menu

The [F5] Graphics menu lets you adjust the amount and complexity of 3D scenery displayed in each window, and the frame rate at which scenery is updated.

1. Auto Complexity: When auto complexity is turned on, the program automatically adjusts scenery complexity to optimize the 3D display/frame rate for your computer system.

2. Flicker Control: Cycles between slower/no flicker, medium/some flicker, and faster/much flicker frame rates.

3. Select Current Window: Lets you make separate image complexity and scenery display adjustments to the first 3D window, second 3D window, and map views. Select the window you wish to adjust before making any display changes.

4. Image Complexity: Toggles through five levels of scenery complexity, from very sparse to very complex.

A thru K: A number of different classes of scenery details are listed (cities, airports, etc.). Each type of scenery may be turned on and off independently by pressing the appropriate key. A + symbol indicates that the scenery is turned on. Most of these scenery details are self-explanatory. The shader option, when on, displays solid shaded 3D scenery. When the shader is turned off, scenery is displayed as wire-frame outlines, resulting in a faster overall frame rate.

[F6] Aircraft Menu

The [F6] Aircraft menu lets you select between available aircraft types and adjust various aircraft control systems.

1. Aircraft Library: Lets you select the type of aircraft you wish to fly.

2. Crash: Toggles crash detection on/off. When off, you can crash into the ground or buildings without causing any damage to your aircraft.

3. Aircraft Control: Adjusts the realism (and difficulty) of flying the aircraft. This option cycles between real, intermediate, and easy aircraft control.

4. Aircraft Loading: Lets you set fuel and payload weights for the current flight, and lists the maximum recommended takeoff weight for the selected aircraft.

5. Mouse Sensitivity: Turns on a menu that lets you adjust mouse flight control and cursor movement rate sensitivities.

6. Joystick/Yoke Sensitivity: If you use one or two joysticks or a flight control yoke, use this menu to adjust aileron, elevator, rudder, and throttle flight control sensitivities.

7. Keyboard Sensitivity: Turns on a menu that lets you adjust keyboard sensitivities (how much effect each keypress will have) for for the aileron, elevator, and rudder control keys.

[F7] Flight Planning Menu

The [F7] Flight Planning menu is used to load optional SubLOGIC Scenery Disks or scenery files, and to reposition your aircraft to any airport or other starting location. This menu also allows you to set inertial reference system waypoints (for aircraft equipped with IRS), review and/or update your flight logbook, and specify active ILS approaches when using ATP with optional SubLOGIC Instrument Pilot's Scenery sets.

1. Scenery Library: Lets you load scenery from either SubLOGIC Scenery Disks or converted scenery files.

2. Position Using Lat/Lon: Lets you reposition your aircraft by specifying the Latitude and Longitude coordinates of the location to which you'd like to move.

3. Position Using N/E: Lets you position your aircraft using the standard SubLOGIC Scenery Disk coordinate system, by specifying the North and East coordinates of the location you'd like to move to. This option can be used with both ATP scenery and when using other Scenery Disks or scenery files.

4. Locator: Activates a menu that lets you select and instantly transport yourself to any of the 26 major airports included with the ATP program.

5. IRS Using Lat/Lon: Lets you specify up to four Latitude/Longitude coordinate waypoints that may be tracked when flying an aircraft equipped with an inertial reference system (IRS).

6. IRS Using N/E: Lets you specify up to four IRS waypoints using standard SubLOGIC North/East coordinate system notation.

7. Logbook: Lets you review or update your flight logbook.

8. ILS Preference: Optional SubLOGIC Instrument Pilot's Scenery sets contain every paved-runway public-access airport and every nav-aid located in the continental United States. Some airports use the same ILS approach frequency at parallel runways, or use the same ILS approach frequency at opposite ends of the same runway. This option lets you select which ILS approach will be active under these types of conditions when flying ATP with the Instrument Pilot's Scenery sets.

[F9] Status Report Menu

The [F9] Status Report menu lists the current simulation parameters in effect. Simulation parameters cannot be adjusted from this menu.

Scenery Area: Lists the currently loaded scenery.

Mode Name: Lists the currently loaded flight mode.

Auto Weather: Indicates the automatic weather generation system status, on or off.

L/L Coords: Lists the aircraft location in Latitude and Longitude coordinates.

N/E Coords: Lists the aircraft location in North and East coordinates.

Altitude: Lists the aircraft MSL (mean sea level) altitude in feet.

Auto Complexity: Indicates whether the automatic scenery complexity adjustment feature is on or off.

Scenery Mask: Indicates which scenery mask is currently selected — cruise, maneuver, or final approach.

Aircraft: Lists the selected aircraft type.

Fuel: Lists the quantity of fuel remaining in pounds.

Total Weight: Lists the total weight of the aircraft.

Controls: Indicates the aircraft control mode in effect — easy, intermediate, or real.

Auto Coord: Indicates whether the auto-coordinated flight option is on or off.

Keyboard: Indicates whether keyboard flight control input is turned on or off.

Stick: Indicates whether optional joystick/yoke flight control input is turned on or off..

Mouse: Indicates whether optional mouse flight control input is turned on or off.

View: Lists which view mode is in effect in each (first and second) 3D window — cockpit, tower, or spot.

Zoom: Indicates the current zoom factor in effect for the first 3D, second 3D, and map windows.

Complexity: Indicates which level of scenery complexity is in effect (from very sparse to very complex) for the first 3D, second 3D, and map windows.

[F10] Help Menu

The [F10] Help menu lists all of the other menus available in ATP, and the keys used to select those menus.

5 Aircraft Controls and Systems

Many controls are used to operate a Boeing 737 aircraft. Primary flight controls, secondary controls, instrument controls, and the navigation and communications radios must all be used throughout the course of a typical commercial transport aircraft flight to ensure that you arrive safely at your destination.

This chapter describes the primary flight controls, secondary aircraft controls, and radio controls you will use when flying the Boeing 737 (and the other Flight Assignment: A.T.P. aircraft). While all aircraft controls must be used for safe and efficient flight, only the primary flight controls are needed to get you up and flying. When you become proficient at using the primary flight controls to fly the aircraft, you can learn how to use the secondary controls, radios, instruments, view adjustment and other simulation controls. While the control functions described in this chapter refer specifically to the Boeing 737 aircraft, these descriptions are equally applicable to all of the other aircraft types you can fly with ATP.

The keyboard can be used to perform all aircraft control functions. An optional mouse, one or two joysticks, and/or SubLOGIC Flight Controls I may be used to enhance simulation realism. See Appendix II for peripheral control device installation and setup instructions.

Primary Flight Controls

The primary flight controls include the control yoke, the rudder pedals, the thrust lever, and brakes. The control yoke and rudder pedals are used to adjust the aircraft control surfaces and cause the aircraft to roll, pitch and yaw around its three axes of rotation (see Figure 5.1).

Roll and Pitch Control

The control yoke is used to operate the ailerons. The ailerons (movable control surfaces located on the outer trailing edge of the wings) control the rotation of the aircraft about its longitudinal axis. This axis extends lengthwise from the nose to the tail of the aircraft as shown in Figure 5.1. The two ailerons are linked so that when one is deflected down, the opposite aileron moves up.

Ailerons control roll, or bank, of the aircraft. Figure 5.2 illustrates the different methods you can use to adjust the ailerons to roll the aircraft to the left or right. Ailerons can be controlled from the keyboard, with a mouse or joystick, or with the SubLOGIC Flight Controls I control yoke. The aileron position indicator on the primary instrument panel shows the current aileron position.

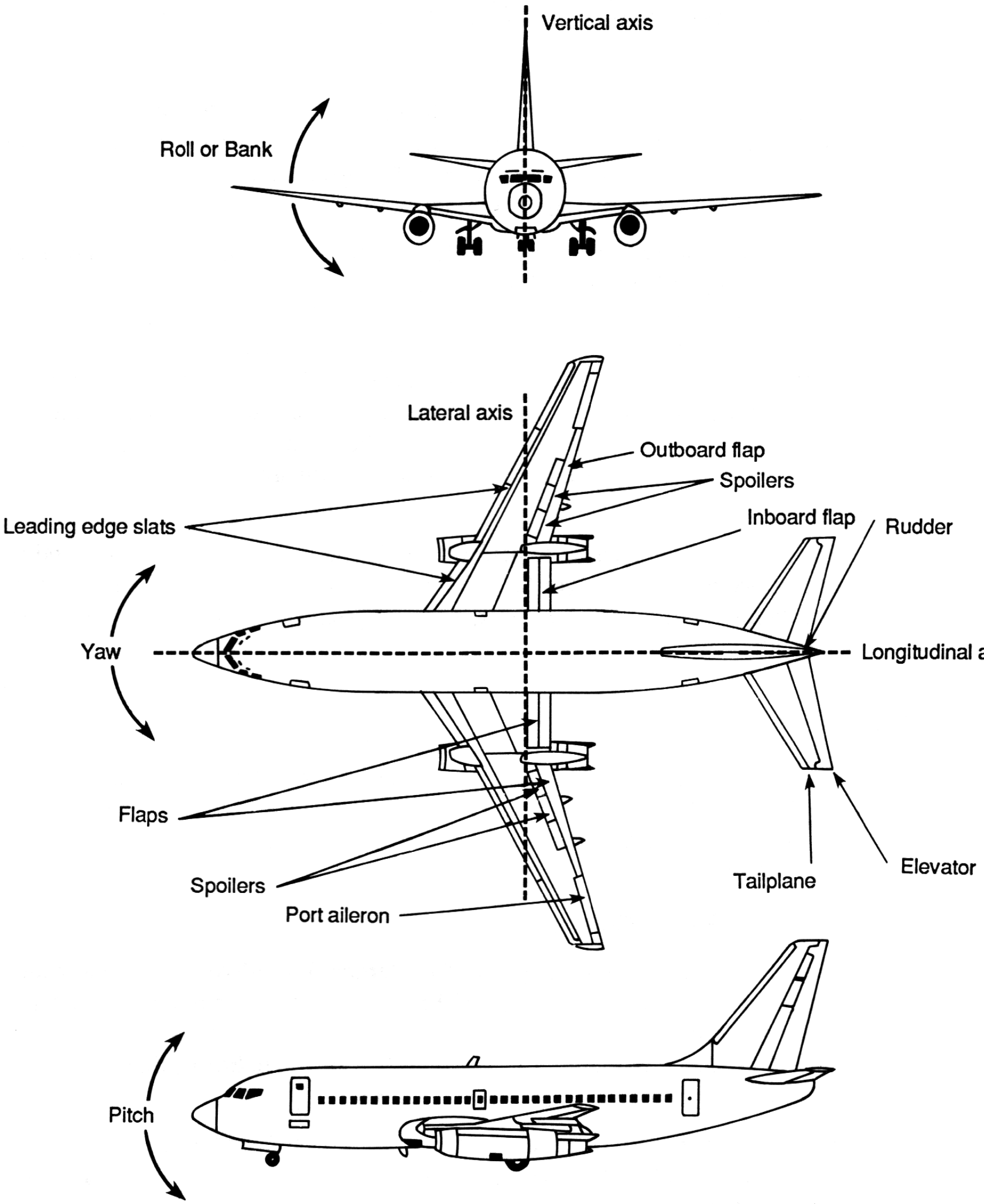


Figure 5.1. B737 Control Surfaces and Axes of Rotation

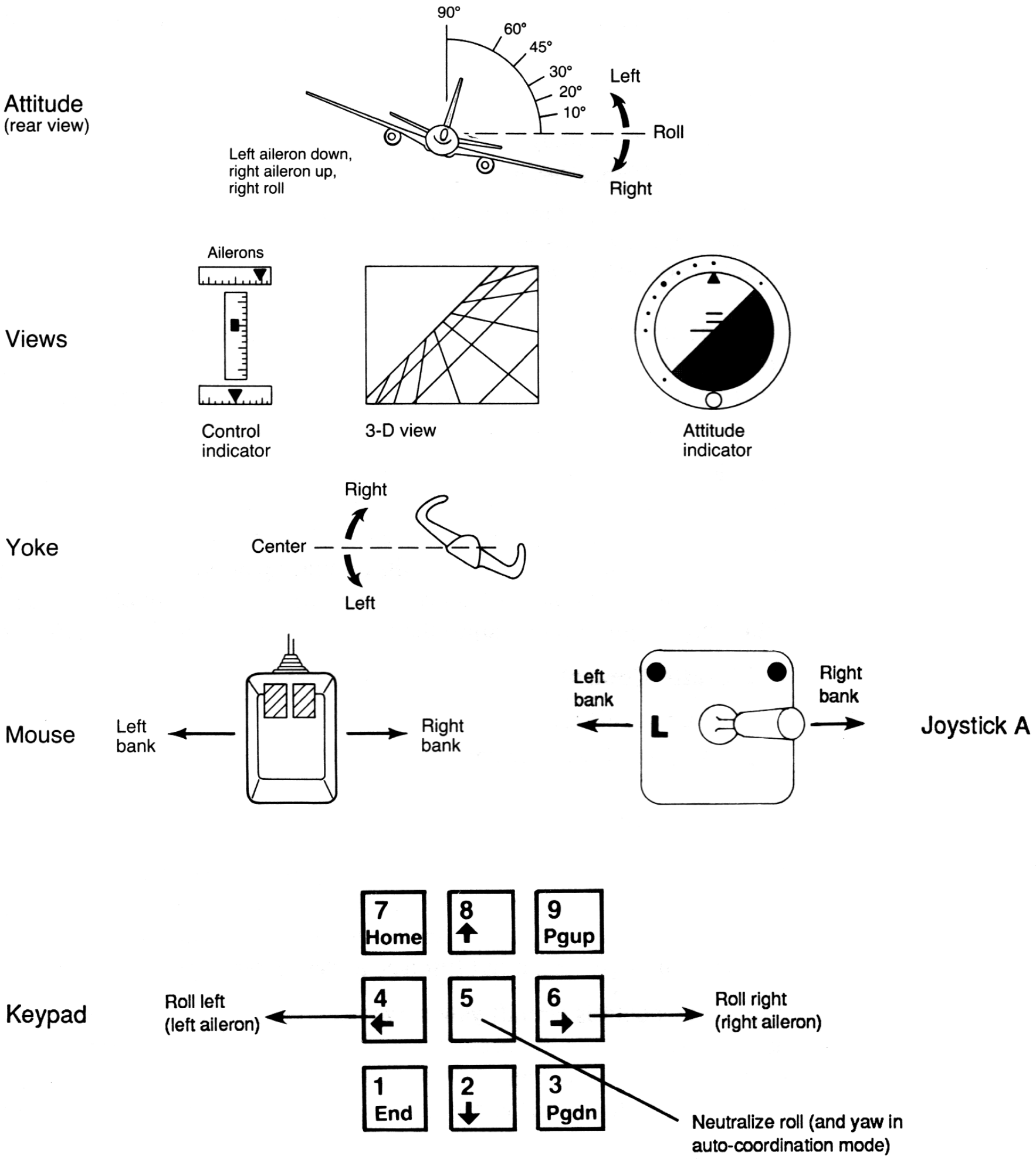


Figure 5.2. Aileron Controls and Effects

Use the following keypad keys to adjust the ailerons when using the keyboard to fly the aircraft:

Aileron Controls	Keys (keypad)
roll left (left aileron)	[4]
roll right (right aileron)	[6]
neutralize roll (center ailerons) (and neutralize yaw in auto-coordination mode)	[5]

The control yoke is also used to operate the aircraft elevator. The elevator (a movable control surface located on the trailing edge of the horizontal stabilizer) is used to control the rotation of the aircraft about its lateral axis. The lateral axis extends through the aircraft fuselage from wingtip to wingtip as shown in Figure 5.1.

The elevator is the angle of attack control that adjusts the pitch attitude of the aircraft. Raising the elevator forces the tail of the aircraft down, and the nose rises. Lowering the elevator forces the tail up, and the nose lowers. Figure 5.3 illustrates the methods used to adjust the elevator to pitch the aircraft up or down. The elevator position indicator on the primary instrument panel shows the current elevator position. Use the following keypad keys to adjust the elevator when flying the aircraft from the keyboard:

Elevator Controls	Keys (keypad)
pitch up (up elevator)	[2]
pitch down (down elevator)	[8]

Yaw Control

Rudder pedals are used to operate the rudder (deflect the rudder from side to side). The rudder is a movable control surface hinged to the fixed vertical stabilizer or fin. The rudder controls the rotation of the aircraft about its vertical axis. This axis extends vertically through the aircraft fuselage at the center of gravity as shown in Figure 5.1.

The rudder controls aircraft yaw movement. Figure 5.4 illustrates the different methods used to yaw the aircraft nose in the desired direction. The rudder position indicator on the primary instrument panel shows the current rudder position. Use the following keyboard keys to adjust the rudder when using the keyboard to fly the aircraft:

Rudder Controls	Keys
yaw left (left rudder)	[<]
yaw right (right rudder)	[>]
neutralize yaw (center rudder)	[L]
auto-coordination on/off toggle	[/]

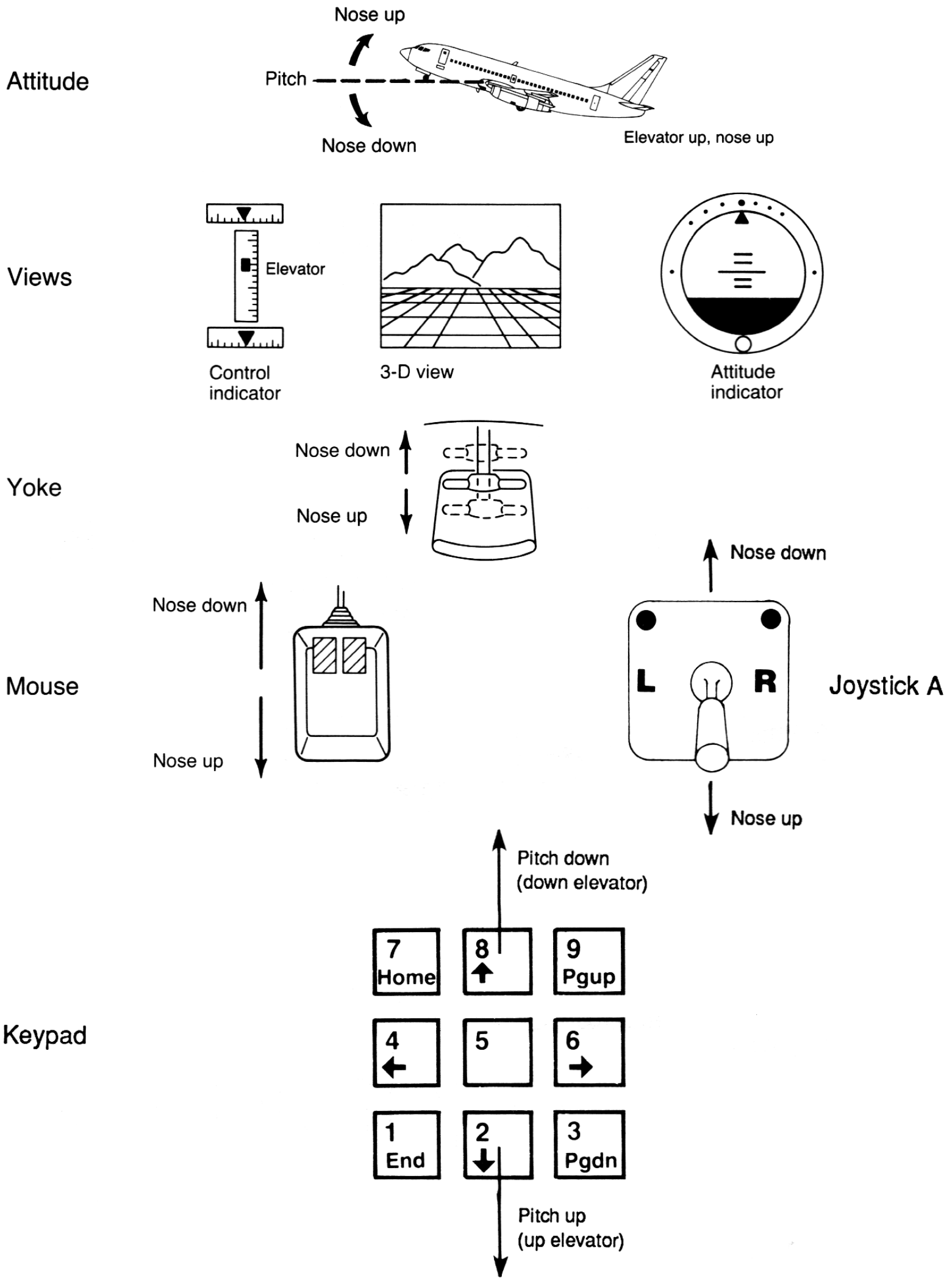


Figure 5.3. Elevator Controls and Effects

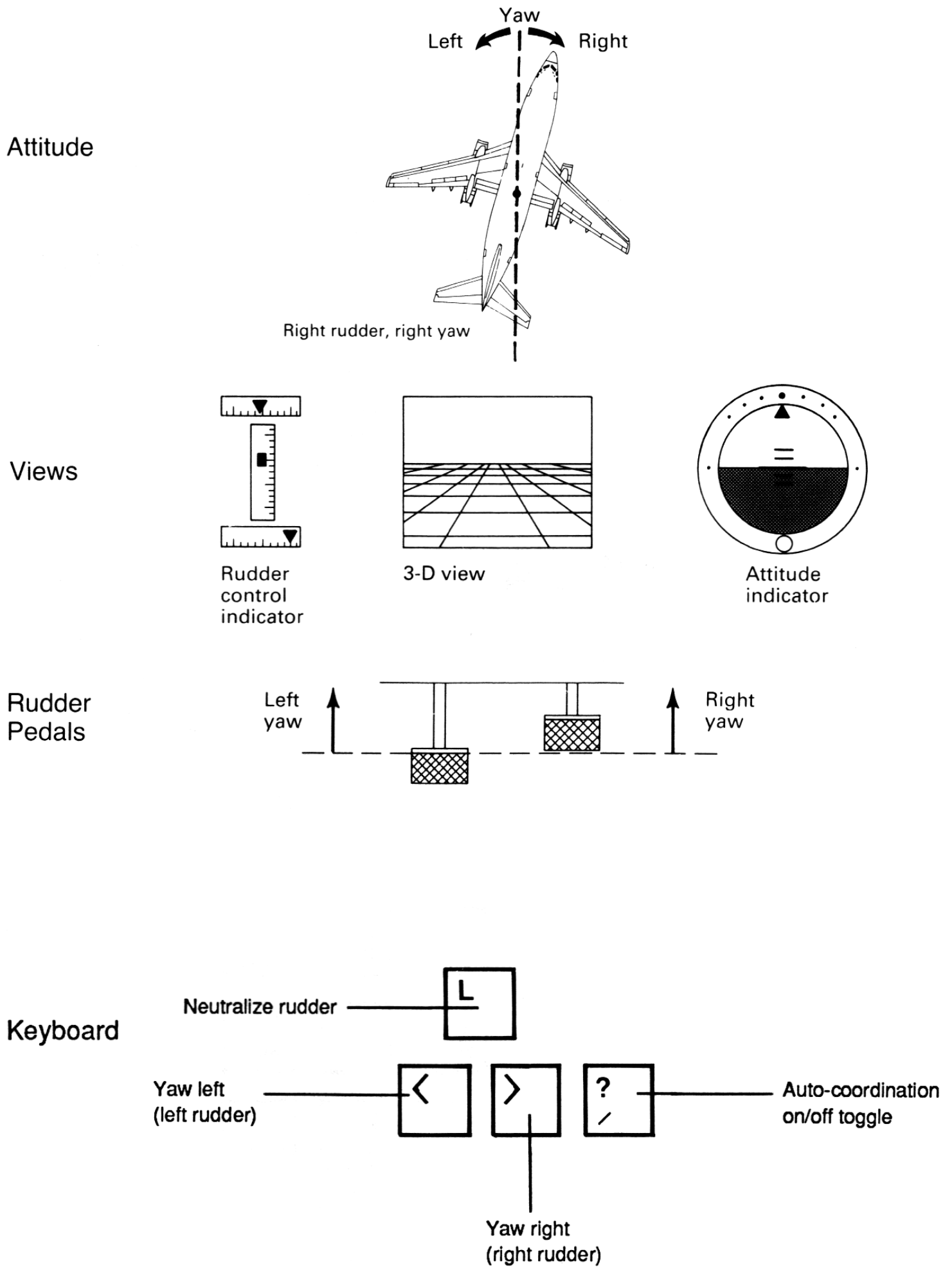


Figure 5.4. Rudder Controls and Effects

Auto-Coordinated Flight

In auto-coordinated flight mode, the ailerons and rudder are linked so that rudder applications are performed automatically when you apply left or right aileron to turn the aircraft. This results in a coordinated turn, and makes the aircraft much easier to fly.

The auto-coordination feature is initially turned on when you load and run the ATP program. When auto-coordination is turned off, you must manually control the rudder to yaw the aircraft to the left or right. Press the keyboard [/] key to toggle the auto-coordination feature off when you want to perform uncoordinated flight maneuvers.

Thrust Control

The thrust lever is used to control the thrust generated by your turbine engines. In the ATP simulation, thrust is quantified in terms of turbine RPM (N_1 or N_2), engine pressure ratio (EPR), or fuel flow to the engines. The thrust indicator on the primary instrument panel shows the current thrust lever setting, from full thrust to full reverse thrust (used to stop the aircraft after landing).

Thrust can be controlled from the keyboard, with a mouse or joystick, or with SubLOGIC Flight Controls I as illustrated in Figure 5.5. Use the following keys to control thrust when using the keyboard to fly the aircraft:

Thrust Controls	Keyboard	Keypad
reverse thrust (from idle)	[9]	
idle thrust	[0]	
decrease thrust	[-]	[3]
increase thrust	[=]	[9]
climb thrust	[I]	
full thrust	[\] or [backspace]	

Note that two sets of control keys may be used to increase or decrease thrust; one set on the keyboard (along with the other predefined thrust control settings), and another set on the keypad (conveniently located near the other primary flight controls). Note also that when using the keyboard for thrust control, you must reduce thrust to idle before you can apply reverse thrust.

Brakes

Wheel brakes are used for slowing, stopping, holding, and steering the aircraft when it is on the ground. Figure 5.5 shows the various control options you can use to apply brakes. Press and hold the [M] key to apply a continuous braking force when using the keyboard flight controls; brakes are applied only while the [M] key is held down. A "BRAKES" indicator appears in the lower left corner of the 3D window display when brakes are applied.

These are wheel brakes only. They have no effect while you are flying the aircraft, and are automatically released when airborne so that you cannot land with the brakes on.

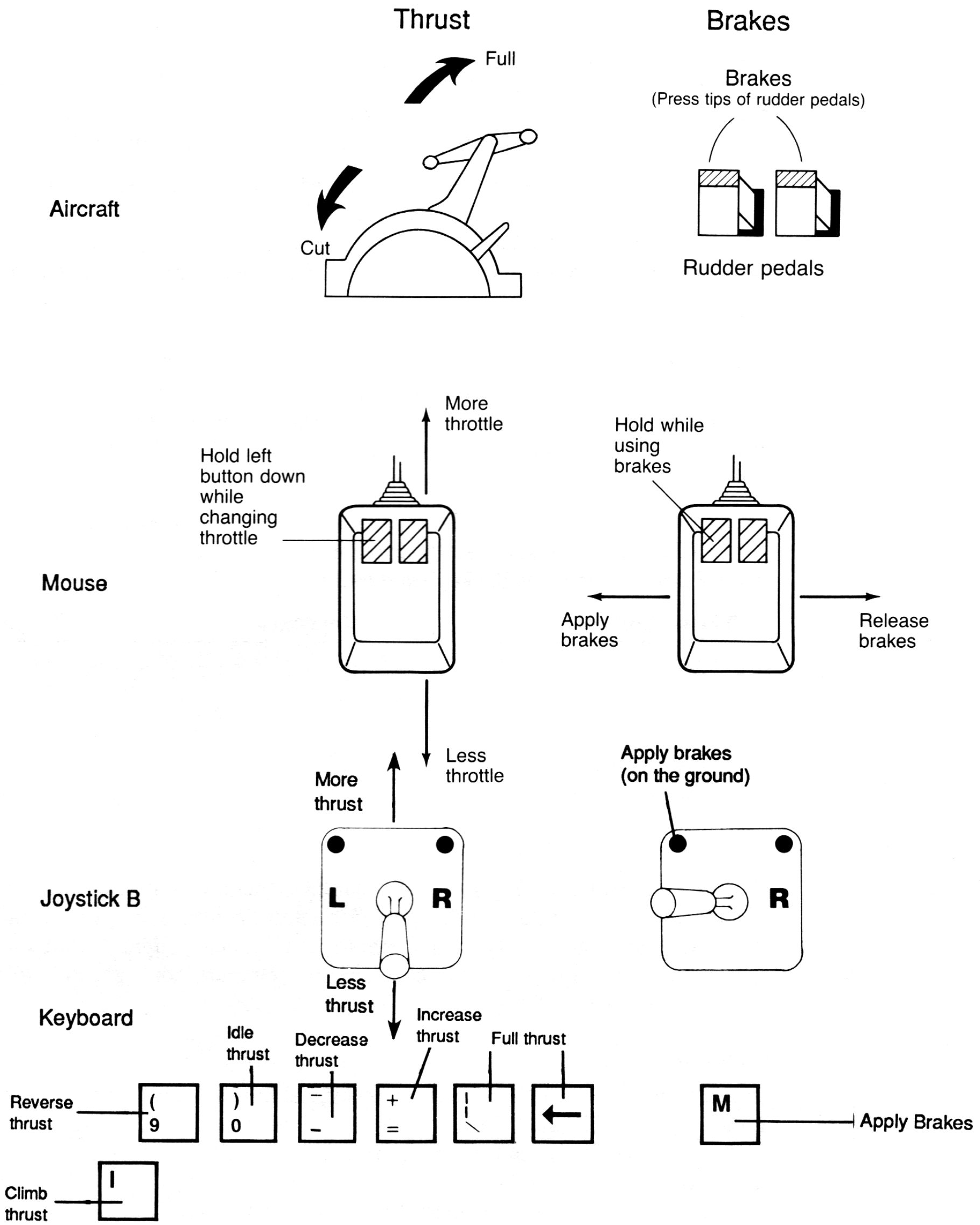


Figure 5.5. Thrust and Brake Controls

Secondary Aircraft Controls

Secondary aircraft controls are used to adjust the secondary control surfaces (elevator trim tabs, flaps and spoilers), and to raise and lower the landing gear.

Elevator Trim

Elevator trim tabs are used to relieve the pilot from having to maintain a continuous pressure on the control yoke in order to keep the elevator in its proper position. These trim tabs are mounted on the elevator, and may be adjusted to counteract the aerodynamic forces that apply pressure to the elevator when the aircraft is flown in an unbalanced flight condition.

When using a joystick or SubLOGIC Flight Controls I for flight control input, do not fly the aircraft in a configuration that requires continual (joystick or yoke) off-center pressure. During pitch and/or power changes, use the joystick or yoke to reach or maintain your goals. Use trim control during or immediately after pitch/power changes to maintain level flight while re-centering the joystick or yoke.

The elevator trim position indicator on the primary instrument panel shows the current elevator trim tab position. Use the following keypad keys to adjust elevator trim as necessary when flying the aircraft with a joystick or SubLOGIC Flight Controls I:

Elevator Trim Controls	Keys (keypad)
adjust elevator trim upward	[1]
adjust elevator trim downward	[7]

In keyboard flight control mode you do not have to hold constant pressures, so these keys take on the altered function of fine elevator control.

Flaps

Wing flaps are hinged, movable panels installed on the inboard trailing edges of the wings. They may be extended downward into the airflow beneath the wings to provide greater lift and more drag, so that the aircraft can descend or climb at a steeper angle or at a slower airspeed. Flaps permit a slower landing speed, thereby decreasing the required landing distance. They may also be used to shorten takeoff distance and provide a steeper climb path.

Flaps may be set to nine different positions on the Boeing 737, from fully retracted (up) to fully deployed (down 40°). Other aircraft have fewer flap settings. The flaps position indicator on the primary instrument panel shows the current flap position. The SubLOGIC Flight Controls I flaps switch may be used to set flaps position.

Use the following keypad keys to adjust flaps to the proper configuration for your flight requirements when flying the aircraft from the keyboard:

Flaps Controls	Keys (keypad)
deploy flaps (one step)	[+]
retract flaps (one step)	[-]

Spoilers

Spoilers are movable panels mounted on the upper surface of each wing that may be extended upward into the airflow over the wing. Their purpose is to "spoil", or disrupt, the smooth flow of air over the wing to reduce the wing's lifting force. Spoilers provide a means of increasing the rate of descent without increasing the aircraft's speed.

Four spoiler positions may be selected; down (retracted), armed (triggered to automatically deploy upon touchdown when reverse thrust is applied), flight position (used to increase the aircraft's descent rate), or up (fully deployed to help bring the aircraft to a stop after a touchdown). Spoilers may be fully deployed only when the aircraft is on the ground; the full UP spoiler configuration setting cannot be selected while the aircraft is airborne. The spoiler position indicator on the primary instrument panel shows the current spoiler setting. Use the following keypad keys to set the spoiler position to the proper configuration for your flight requirements:

Spoiler Controls	Keys (keypad)
deploy spoilers (one step)	[Ins]
retract spoilers (one step)	[Del]

Landing Gear

The landing gear must be raised when flying the aircraft, both to reduce drag and to ensure that the gear will not be damaged by wind buffeting at high airspeeds.

The gear position indicator on the primary instrument panel shows current landing gear status. Use the following keys to retract the landing gear after takeoff and extend the gear prior to runway touchdown:

Landing Gear Controls	Keys
retract landing gear	[right bracket]
extend landing gear	[left bracket]

Navigation and Communications Radio Controls

Radios and radio-controlled instruments are used to perform a wide variety of navigation, communications, and aircraft control functions. The SubLOGIC Boeing 737 aircraft is equipped with two VOR/ILS navigation radios (NAV1 and NAV2), a distance measuring equipment (DME) indicator source-switchable between NAV1 and NAV2, an automatic direction finder (ADF) navigation radio used to tune non-directional radio beacons (NDBs), two communications radios (COM1 and COM2), and a transponder (XPNDR) that transmits an identifier code and aircraft location information to Air Traffic Control (ATC). Navigation indicators and instruments controlled with the navigation radios include an attitude director indicator (ADI) driven by NAV1, a horizontal situation indicator (HSI) driven by NAV2, a radio magnetic indicator (RMI) used to track VOR and/or NDB stations tuned on the NAV and ADF radios, and an autopilot that can track a VOR station tuned on either NAV radio. All other aircraft (with the exception of the Boeing 737) are also equipped with an inertial reference system (IRS) used to track pilot-specified waypoints along a flight route.

Navigation Radio Controls

All navigation radios, nav-radio-driven indicators, and pilot-settable instrument bugs are located on the primary instrument panel. Navigation control functions must be performed while holding down the [Shift] key.

Navigation Radio/Indicator/Bug Selection

You must select a nav radio, indicator or bug before you can adjust it or perform any operations on it. Use the following keystroke combinations to select the item you want to adjust:

Function	Keyboard
select NAV1	[Shift][1]
select NAV2	[Shift][2]
select DME	[Shift][3]
select ADF	[Shift][4]
select IRS	[Shift][5]
select RMI1	[Shift][6]
select RMI2	[Shift][7]
select heading bug	[Shift][8]
select airspeed bug	[Shift][;]
select radio altimeter bug	[Shift][']

A small diamond-shaped highlight symbol on the primary instrument panel (or a + symbol on low-res screen displays) indicates the currently selected navigation radio, indicator or bug. Press several of the keystroke combinations listed above and notice that the diamond symbol moves around the instrument panel to a location on or near each selected item in turn. The [Shift][5] selection does not register, since the Boeing 737 aircraft is not equipped with IRS.

Navigation Radio/Indicator/Bug Adjustments

The following keystroke combinations are used to adjust the selected item (above). Detailed adjustment instructions for each navigation radio, indicator, and bug are provided in the following sections of this chapter:

Function	Keyboard
increase full MHz frequency (coarse increase bug setting)	[Shift][=]
decrease full MHz frequency (coarse decrease bug setting)	[Shift][-]
increase fractional kHz frequency (fine increase bug setting)	[Shift][right bracket]
decrease fractional kHz frequency (fine decrease bug setting)	[Shift][left bracket]
increase OBS setting	[Shift][0]
decrease OBS setting	[Shift][9]
nav-transmitter ident. code on	[Shift][I]
nav-transmitter ident. code off	[Shift][O]

NAV1 and NAV2 (VOR/ILS/Indicator) Functions

NAV radios are used to tune in and identify VOR stations so you can fly toward or away from them. Two NAV radios are provided so that you can simultaneously tune two VOR stations and crosscheck your position. NAV radios are also used to tune ILS localizer frequencies to facilitate instrument runway approaches.

NAV radios must be tuned to the correct VOR or ILS localizer frequency in order to receive and decode the transmitted signal. Select the NAV radio you want to adjust (press [Shift][1] for NAV1, or [Shift][2] for NAV2), then use the [Shift][=] or [Shift][-] keys to increase or decrease the full megahertz (Mhz) frequency value tuned on the selected NAV radio. Use the [Shift][right bracket] or [Shift][left bracket] keys to increase or decrease the fractional kilohertz (kHz) frequency value in 50 kHz increments (.05, .10, .15, etc.).

When you've tuned the selected NAV radio to the correct VOR or localizer frequency, press [Shift][I] and you should hear an audible identification code for the tuned navigation station. The ident code confirms that you've correctly tuned the nav-station on the NAV radio, and that the station is transmitting correctly. Press [Shift][O] to turn off the ident code. An already running ident code will continue until completed.

The attitude director indicator (ADI) is used to track the nav-aid tuned on the NAV1 radio, and the horizontal situation indicator (HSI) is used to track the NAV2-tuned nav-aid. Use the [Shift][0] or [Shift][9] keys to increase or decrease the appropriate omni-bearing selection (OBS) setting when the selected NAV radio is tuned to a VOR station. The OBS box for the NAV1 radio is located in the upper left corner of the ADI. The OBS box for NAV2 is located in the upper left corner of the HSI.

DME (Distance Measuring Equipment) Functions

The DME indicator shows your distance in nautical miles from the VOR and/or ILS localizer stations tuned in the NAV1 and NAV2 radios. This indicator will display a distance reading only when the tuned station is transmitting DME information. (Most VOR stations and many ILS stations also transmit DME information.) Press [Shift][3] to select the DME indicator. Press [Shift][=] to cycle forward from DME1 (distance to the nav-station tuned on NAV1), to DME2 (distance to the NAV2-tuned nav-station), to HOLD2. Press [Shift][-] to cycle backwards from DME2 to DME1 to HOLD1. The hold function is used to hold the VOR transmitter-distance display in the DME indicator when tuning the referenced NAV radio to a different frequency. This function is most often used prior to tuning both NAV radios to the same ILS localizer frequency (for safety reasons) on a runway approach, when the ILS doesn't have a DME transmitter associated with it. This can occur at many medium-sized airports with ILS facilities.

ADF (Automatic Direction Finder) Functions

The ADF navigation radio is used to tune non-directional radio beacons (NDBs). Press [Shift][4] to select the ADF radio. Use [Shift][=] or [Shift][-] to increase or decrease the most-significant-digits frequency value, and use [Shift][right bracket] or [Shift][left bracket] to increase or decrease the least-significant-digits frequency value on the ADF radio. Either radio magnetic indicator (RMI) needle (RMI1 or RMI2) may be used to determine relative bearing to the tuned NDB by setting the appropriate RMI reference selecter to the ADF position. RMI adjustments are described below.

IRS (Inertial Reference System) Functions

IMPORTANT NOTE; The Boeing 737 does not support IRS, but it is available on all other ATP aircraft. Select an aircraft equipped with IRS before you attempt to make any IRS instrument adjustments. See Chapter 15 for a complete IRS description and waypoint entry instructions.

Press [Shift][5] to select the IRS, then use [Shift][=] or [Shift][-] to select one of four waypoints (previously stored using option 5 or option 6 on the [F7] Flight Planning menu) to be tracked on the horizontal situation indicator (HSI). When the IRS is

selected, the [Shift][=] or [Shift][-] keys may be used to cycle the waypoint indicator in the lower right corner of the HSI forwards or backwards through W1 (waypoint 1), W2, W3, W4, and off.

Select a waypoint, then press [Shift][2] to reference the NAV2 radio and use [Shift][0] or [Shift][9] to increase or decrease the HSI OBS setting, center the vertical CDI needle, and use the HSI to track the waypoint in the same way you would track a VOR station. Press [Shift][5] again to re-select the IRS when you want to choose a different waypoint to track, or when you want to cycle the waypoint indicator to the off position. When set to off, the HSI reverts to receiving the navigation station signal tuned on the NAV2 radio.

RMI1 and RMI2 (Radio Magnetic Indicator) Functions

The RMI is used to determine the bearing to two different VOR stations, or to a VOR station and a non-directional radio beacon (NDB) relative to your heading.

Press [Shift][6] to select the RMI1 reference selecter in the lower left corner of the RMI, then use [Shift][=] or [Shift][-] to toggle between the VOR (NAV1) and ADF positions. When the RMI reference selecter is set to the VOR position, the RMI1 needle (the thin white needle) points to the relative bearing of the VOR station tuned on the NAV1 radio. When set to the ADF position, the RMI needle points to the relative bearing of the NDB station tuned on the ADF radio.

Press [Shift][7] to select the RMI2 reference selecter in the lower right corner of the RMI. Use [Shift][=] or [Shift][-] to toggle between VOR (NAV2) and ADF. The RMI2 needle (the thick yellow needle) points to the VOR station tuned on the NAV2 radio when VOR position is selected, and points to the NDB station tuned on the ADF radio when ADF position is selected. If you are flying an aircraft equipped with IRS (see above description), the RMI2 needle will point to the currently selected waypoint set on the waypoint indicator when the RMI2 reference selecter is set to VOR position.

Heading, Airspeed, and Radio Altimeter Bugs

The heading bug indicator box in the upper right corner of the horizontal situation indicator (HSI) is used to set a target heading for the autopilot to follow, or to set a pilot reference heading. Press [Shift][8] to select the heading bug indicator. Use [Shift][=] or [Shift][-] to increase or decrease the heading bug indicator setting in 10° increments, and use [Shift][right bracket] or [Shift][left bracket] to increase or decrease the heading in one-degree increments.

The open diamond-shaped airspeed bug on the airspeed indicator is used to set pilot reference airspeeds (V_1, V_R, V_2, etc.). Press [Shift][;] to select the airspeed bug. Use [Shift][=] or [Shift][-] to make coarse increase or decrease adjustments, and [Shift][right bracket] or [Shift][left bracket] to finely increase or decrease the airspeed setting.

The open diamond-shaped radio altimeter bug on the radio altimeter is used to set a decision height for a runway landing approach. Press [Shift]['] to select the radio altimeter bug, then use [Shift][=] or [Shift][-] to make coarse increase or decrease adjustments, and [Shift][right bracket] or [Shift][left bracket] to finely increase or decrease the decision height setting. The radio altimeter bug setting triggers the decision height (DH) light in the upper right corner of the attitude director indicator (ADI). The DH light is turned off when you are above the specified decision height. The DH light turns green when you reach the decision height altitude, and turns red when you drop fifty feet below the specified decision height.

Autopilot Functions

The following keystroke combinations are used to enable the autopilot and adjust the autopilot flight control options:

Function	Keyboard
autopilot master on/off toggle	[Shift][Z]
autopilot heading toggle: heading bug/NAV1/NAV2/off	[Shift][X]
autopilot altitude toggle: altitude hold/off	[Shift][C]

Press [Shift][Z] to toggle the autopilot master on or off. The autopilot master must be turned on before you can enable the heading hold and/or altitude hold components of autopilot flight control. The autopilot status indicator on the primary instrument panel shows the current autopilot status.

Press [Shift][X] to turn on the autopilot heading toggle switch (located on the secondary instrument panel) and cycle the autopilot through four different *heading hold* flight modes: heading bug/NAV1/NAV2/off. The first [Shift][X] keypress causes the autopilot to follow the target heading set in the heading bug indicator box on the HSI. A second [Shift][X] keypress causes the autopilot to track the VOR station tuned on the NAV1 radio, and a third [Shift][X] keypress causes the autopilot to track the NAV2-tuned VOR station. Press [Shift][X] a fourth time to turn the autopilot heading toggle switch off and disable the heading hold component of autopilot flight control.

Press [Shift][C] to turn on the autopilot altitude toggle switch (located on the secondary instrument panel). The autopilot locks the aircraft into the current altitude unless thrust is set too low. Press [Shift][C] again to turn the autopilot pitch toggle switch off and disable the altitude hold component of autopilot flight control.

Communications Radio Controls

Communications radios are located on the primary instrument panel. All communication control functions must be performed while holding down the [Ctrl] key.

Communications Radio Selection

You must select a communications radio before you can adjust it. Use the following keystroke combinations to select the radio you want to adjust:

Function	Keyboard
select COM1	[Ctrl][1]
select COM2	[Ctrl][2]
select XPNDR	[Ctrl][3]

A small diamond-shaped highlight symbol on the primary instrument panel (or a + symbol on low-res screen displays) indicates the currently selected communications radio. The diamond symbol moves around the instrument panel to a location on or near each radio as it is selected.

Communications Radio Adjustments

The following keystroke combinations are used to adjust the selected radio:

Function	Keyboard
increase full MHz frequency (increase most-significant-digits)	[Ctrl][=]
decrease full MHz frequency (decrease most-significant-digits)	[Ctrl][-]
increase fractional kHz frequency (increase least-significant-digits)	[Ctrl][right bracket]
decrease fractional kHz frequency (decrease least-significant-digits)	[Ctrl][left bracket]

COM1 and COM2 (Communications Radio) Functions

COM radios are used to communicate with ATIS (Automatic Terminal Information Service), clearance delivery, ground control, the control tower, approach/departure control, and all Air Traffic Control (ATC) centers. Two COM radios are provided for backup purposes. The second COM radio may also be tuned ahead of time (if you know the correct frequency) in anticipation of being transferred to another control facility.

Press [Ctrl][1] to select the COM1 radio, or [Ctrl][2] to select the COM2 radio. Use [Ctrl][=] or [Ctrl][-] to increase or decrease the full megahertz frequency value tuned on the selected COM radio, and use [Ctrl][right bracket] or [Ctrl][left bracket] to increase or decrease the fractional frequency value.

Single keystroke-combination communications with Air Traffic Control are sent over the tuned frequency on the selected COM radio.

XPNDR (Transponder) Functions

The transponder is used to identify your aircraft, flight number, altitude, and unique 4-digit transponder "squawk" code on the Air Traffic Control radar screen. Press [Ctrl][3] to select the transponder, then use [Ctrl][=] or [Ctrl][-] to increase or decrease the most-significant-digits value, and use [Ctrl][right bracket] or [Ctrl][left bracket] to increase or decrease the least-significant-digits setting on the transponder. Air Traffic Control will request you to enter a specific 4-digit transponder "squawk" code prior to takeoff, to enable the ATC radar screen to identify and distinguish your aircraft once you are airborne.

6 View Controls

Flight Assignment: A.T.P. has a sophisticated viewing system that gives you a wide range of views from the aircraft as well as views of your aircraft as you fly. This chapter describes how to use the program's windows and window view options.

Windows and window views are controlled from the keyboard and from the [F4] Views menu. The ATP program follows the standard flight instructor's convention of separating the flight functions of aircraft control, navigation, and communications. View adjustments are considered to be a navigational function, which means that all keyboard view controls must be performed while holding down the [Shift] key.

Using Windows

You can have two 3D windows on the screen simultaneously, each displaying a different cockpit or external aircraft view and each set to a different zoom factor. A map window can also be displayed on the screen to provide a map view of the area in which you are located. This is useful in navigation and for taxiing around airports.

Turning Windows On and Off

Use the following keystroke combinations to toggle each window on or off:

Function	Keys
first 3D window on/off	[Shift][backspace]
second 3D window on/off	[Shift][Num Lock]
map view on/off	[Shift][Scroll Lock]

The more windows you turn on, the slower the overall simulation frame rate will be. A single window display provides the fastest frame rate.

When you turn a window off, the window still may be displayed on the screen even though it has been turned off (deactivated), since only the active portions of the screen display (turned-on windows, instrument panel, etc.) are continually updated. Press [Esc] to refresh the entire screen display, and the turned-off window will disappear.

Selecting a Window

You must select a window before you can make any adjustments to it. Only one window may be selected at a time. The currently selected window is outlined in white, and is listed in the selected window/zoom factor indicator box (Figure 3.1, item 14) on the primary instrument panel. Other windows have black outlines. When only one window is turned on that window is automatically the selected window. Press [Shift][Ins] to cycle through the turned-on windows and select the window you want to adjust:

Function	Keys (keypad)
cycle through turned-on windows and select window to be adjusted	[Shift][Ins]

Changing Window Overlap Priority

When multiple display windows are turned on, you can specify the order in which the two 3D windows and/or the map window will overlap one another. To change the overlap order, select the window you want to place on top and then press [Shift][P] to give it the top overlap priority:

Function	Keys
give selected window top overlap priority	[Shift][P]

In the default startup flight mode that loads when you run the ATP program, the first 3D window fills the entire screen above the instrument panel. If you turn on additional windows and then assign top overlap priority to the first 3D window, it will overlap the other windows so that they cannot be seen. Assign top overlap priorities to the smaller second 3D and map windows to display them over the first 3D window. Window sizes and locations may be adjusted on the [F4] Views menu to minimize this problem. [F4] Views menu adjustments are described later in this chapter.

3D Window View Options

The two 3D windows can display a wide variety of different cockpit views, as well as aerial (spotter plane) and ground-based (control tower) views of the aircraft you are flying.

View Mode Selection

Any one of three different view modes may be displayed in the selected 3D window. Select the window you want to adjust (if both 3D windows are turned on), and press [Shift][Caps Lock] to cycle through cockpit, tower, and spot view modes:

Function	Keys
cycle through selected 3D window view modes: cockpit/tower/spot	[Shift][Caps Lock]

Cockpit - Provides an out-the-windshield view from the flight deck of the aircraft you are flying.

Tower - A view of your aircraft from a stationary control tower. When the autozoom feature is selected (option 6 on the [F4] Views menu) this view mode automatically tracks your movements to keep you in sight.

Spot - A view of your aircraft from a nearby spotter plane that follows you as you fly. Spot plane location, altitude, distance and tracking characteristics are adjusted on the [F4] Views menu.

A title bar at the top of the 3D window identifies which view mode is in effect. The [F4] Views menu lets you turn window titles off to improve frame rate.

Moving the Control Tower

When tower view mode is displayed in the selected 3D window, pressing [Shift][/] automatically places the control tower one nautical mile from your current aircraft location at a 20° left offset relative to your heading. This option allows you to "drag" the control tower along with you on long cross-country flights, and continually reposition it at a nearby location:

Function	Keys
place control tower at current aircraft location (in tower view mode)	[Shift][/]

Zoom Control

Zoom control is available in all view modes. Press [Shift] in combination with the keypad [+] and [-] keys to zoom in or out as desired on the selected window view:

Function	Keys (keypad)
zoom in	[Shift][+]
zoom out	[Shift][-]

Zoom controls let you adjust the selected window field of view. View effects from wide angle to a super-telephoto view are possible.

The selected window/zoom factor indicator box on the primary instrument panel (Figure 3.1, item 14) shows the current zoom factor in effect for the selected 3D window. When precise aircraft control is required (during takeoffs and landings, for example), be sure to reset the cockpit view zoom factor to 1X (normal field of vision)

to eliminate any view distortion effects that may adversely effect your sense of direction or movement. Use [Shift][N] to reset the zoom factor to 1X in the selected 3D window view:

Function	Keys
reset 1X zoom factor	[Shift][N]

The zoom control keys are also used to zoom in and out on the map window view. Map window use is described in the next section of this chapter.

View Direction Selection

In cockpit view mode you can look in nine different directions. Press [Shift] in combination with one of the keypad direction keys to specify a cockpit view direction on the selected window:

View direction	Keys (keypad)
forward	[Shift][8]
left front	[Shift][7]
right front	[Shift][9]
left	[Shift][4]
right	[Shift][6]
left rear	[Shift][1]
right rear	[Shift][3]
rearward	[Shift][2]
down	[Shift][5]

The view direction keys allow you to look around and scan the skies for nearby air traffic, and to properly orient yourself relative to ground-based visual cues. Just remember that the view direction selection keys are centered around the keypad [5] key. Pressing [Shift][5] gives you a straight downward view.

View Direction Adjustments

You can make fine adjustments to the cockpit view direction by using a set of keyboard controls centered around the [G] key to "pan" left, right, upward or downward. Use the following keystroke combinations to adjust the selected window view direction:

Adjust view direction	Keys
up	[Shift][T]
down	[Shift][B]
left	[Shift][F]
right	[Shift][H]
reset default window view	[Shift][G]

These controls are especially useful for adjusting side views up or down to keep the horizon in sight when banking sharply to the left or right. They are also helpful in panning the cockpit forward view left or right to locate an airport, and for adjusting the forward view up or down as required on a final landing approach.

You may become disoriented if you adjust a cockpit view far away from the specified view direction. (In fact, it's possible to rotate the view a full 360° by repeatedly pressing the same keystroke combination.) Horizontal and vertical view adjustments remain in effect when you change view direction, another potential source of confusion. Remember that pressing [Shift][G] resets the selected window to the default view direction.

Second 3D Window Autoview

An autoview option exclusive to the second 3D window provides added versatility and realism. This options acts as a second set of "intelligent eyes" that can automatically lock onto and track a specified location. Use the following keystroke combinations to turn the second 3D window autoview option on and off:

Function	Keys
autoview on	[Shift][Q]
autoview off	[Shift][tab]

These keystroke combinations may be used in place of the normal window controls to turn on the second 3D window (with the autoview option automatically activated), and to turn off the second 3D window.

Press [Shift][Q] to turn on the second 3D window (if off) and select the autoview option. The second 3D window automatically locks onto and begins to track the location in the center of the first 3D window cockpit view. For example, if you're looking directly at an airport in the first 3D window and you press [Shift][Q], the second 3D window will turn on and keep the airport in view as you continue to fly and maneuver the aircraft. The view of the airport in the second 3D window will be displayed in the proper perspective relative to your current location and orientation.

Press [Shift][tab] again to disable the autoview option and turn off the second 3D window.

There are several important facts to keep in mind when using autoview. The first 3D window must be turned on and must be in cockpit view mode in order for the autoview option to work. Any view adjustments made to the first 3D window view are ignored by the autoview option; the second 3D window view locks onto and tracks the *unadjusted* first 3D window center location. When the second 3D window is already turned on, selecting the autoview option supercedes the currently-selected second 3D window view display.

Map Window View Options

The map window displays a downward-looking map view of the area over which you are flying. You can zoom out to display a large area (useful as a navigational aid to help you determine your location when flying the aircraft), or zoom in to examine a small area in detail (useful for taxiing around airports).

Press [Shift][Scroll Lock] to turn on the map window. The same zoom controls used to adjust 3D window views are used to zoom in and out on the map window. Press [Shift] in combination with the keypad [+] and [-] keys to zoom in or out as desired on the map window view, and press [Shift][N] to reset the standard map window zoom factor. The [F9] Status Report menu lists the current map window zoom factor in effect. Remember that when multiple windows are displayed, you must select the window you wish to adjust. The selected window is outlined in white, other windows in black.

[F4] Views Menu

A variety of view options are only accessible from the [F4] Views menu (see Figure 6.1). These options let you specify the spot plane parameters, adjust the size and location of windows, turn window titles and a control position indicator window on and off, and adjust several 3D window external view display characteristics.

Press [F4] to select the Views menu from normal flight mode. Remember that any changes you make to a menu option take effect as soon as you exit from the menu (press [Esc] or [space bar]) and return to normal flight mode.

VIEWS (F4)

1 Position Spot Plane
2 Window Orientation
3 + Window Titles
4 + Control Position Indicator
5 + Full Screen External View
6 + Autozoom Tower View

(Press ESC to Exit)

Figure 6.1. Views Menu

Spot Plane Control

Select [F4] Views menu option 1, Position Spot Plane, to turn on a sub-menu that lets you adjust the direction, altitude and distance from which your aircraft will be viewed in spot view mode. Spot plane tracking characteristics are also adjusted from this menu.

A small view box (near the aircraft on the menu) shows the location of the spot plane relative to your aircraft. This box can be moved in a circle about the aircraft either by dragging it with a mouse, or by pressing the keypad direction keys ([4], [6], [8] and [2] for left, right, forward, and back view positions respectively). Use the mouse or the direction keys to move the view box to the desired position.

The altitude option sets the difference in altitude (in feet) between the spot plane and your aircraft. Positive values place the view position above you, negative values place the view position below you. The spot plane cannot go below ground level. Adjust spot plane altitude by selecting this option and typing a value followed by [Enter].

The distance option sets the distance of the spot plane (in feet) from your aircraft in the specified view direction. Only positive values are allowed here. Select the option and type the desired value followed by [Enter].

Aerobatic maneuvers are not recommended for any of the aircraft you can fly with ATP. Nevertheless, you may at some time attempt to roll or pitch (loop) the aircraft past 90° and turn it upside down. When you roll past 90°, the spot plane must quickly switch over to the other side of your aircraft to maintain it's specified location relative to your left and right wings as they swap positions. This switch can prevent the spot plane from providing a clear view of the roll maneuver. You can compensate for this by making the spot plane track relative to your heading instead of your wingtip location, but then you'll experience a problem when you pitch the aircraft up past 90° and immediately reverse heading.

The preference option lets you resolve these problems by specifying the circumstances under which spot plane transitions occur. Set preference to roll and the spot plane tracks relative to your heading, displaying an uninterrupted view of roll maneuvers. Set preference to loop and the spot plane tracks relative to your wing position, providing a clear view of loop-type maneuvers where you pitch the aircraft up and over.

The transition option lets you specify a fast or slow spot plane transition. When you select fast transition the spot plane locks onto your aircraft and follows it closely, and switches sides abruptly in a transition. Select slow transition and the spot plane gradually moves into the proper location as you maneuver the aircraft (which results in a much smoother tracking action).

Moving and Sizing Windows

Select [F4] Views menu option 2, Window Orientation, to turn on a sub-menu that lets you adjust the size and/or positions of the two 3D windows, the map window, the instrument panel, and the control position indicator window. All windows can be moved from this menu, and the 3D and map windows can be adjusted to any allowable size. Windows also can be turned on or off from this menu.

Many window moving and/or sizing operations may also be performed directly with a mouse without selecting this [F4] Views menu option.

When you're finished moving, sizing, and/or turning windows on and off, press [Esc] to refresh the entire screen display. This erases any deactivated windows or menus from the unused areas of the screen display, and provides an accurate view of the adjustments you've made.

Moving Windows

On the window orientation sub-menu, select the move option for the window you want to move. The menu will disappear when you select the option. Use the keypad direction keys [4], [6], [8] and [2] to move the window left, right, up and down respectively. The instrument panel can only be moved up or down. When you're finished moving the window, press [Esc] or [Enter] to return to the window orientation menu.

Alternately, point the mouse cursor at the very top of the window, press and hold the left mouse button, and drag the window to a new position.

Sizing Windows

The two 3D windows and the map window may be adjusted to any size. Instrument panel and control position indicator sizes are not adjustable.

On the window orientation sub-menu, select the size option for the window you want to adjust. The menu will disappear when you select the option. Use the keypad direction keys [4], [6], [8] and [2] to make the window narrower, wider, shorter and taller respectively. When sizing a window, you can also use the [F], [H], [T] and [B] keys to move the window left, right, up and down respectively. When the window set to the correct size, press [Esc] or [Enter] to return to the window orientation menu.

Alternately, point the mouse cursor at the lower right corner of the window, press and hold the left mouse button, and drag the corner until the window is the desired height and width.

Window Titles

A title bar at the top of the 3D window(s) identifies which view mode is in effect (cockpit, tower, or spot). A title bar also identifies the map window. Use option 3, Window Titles, on the [F4] Views menu to toggle window titles on and off.

Control Position Indicator

Select [F4] Views menu option 4, Control Position Indicator, to toggle on and off a small window which shows the current position of the primary flight controls — ailerons, elevator, rudder and throttle. This indicator helps you fly the aircraft in full screen external view mode when the instrument panel is not visible.

Full Screen External View

Option 5, Full Screen External View, is used to display full screen views of the aircraft in tower and spot view modes. The instrument panel is not displayed when external aircraft views are selected.

Autozoom Tower View

Use option 6, Autozoom Tower View, to toggle the tower view autozoom feature on and off. When this option is selected, the tower view zooms in and out automatically to keep your aircraft in sight no matter how near or far away you fly.

7 Flight Physics and Aircraft Control

Using text and illustrations to explain methods of flight and aircraft control is a highly abstract process. The difficulty of explaining a dynamic event such as aircraft flight control without personal "hands-on" contact may seem almost insurmountable. Still, a clear and concise set of instructions can provide real benefits, so this chapter was written with the understanding that only a qualified flight instructor in a real aircraft can teach you how to fly a real airplane.

This chapter provides a crash course in basic flight physics and Boeing 737 aircraft control designed to give you a background appropriate to the flight lessons presented in the following chapter. The goal of this chapter is to help you more fully enjoy the entertainment and instructional value of Flight Assignment: A.T.P. without letting you develop habits that could interfere with any future real flight training. We want you to have fun while practicing correct flight procedures.

Standard Terminology and Abbreviations

Discussions of flight physics and aircraft control frequently refer to your aircraft's *axis of rotation* (refer to Figure 5.1 in Chapter 5). All axes of rotation pass through the aircraft's center of mass; rotations about any axis occur about the center of mass.

A *vector* is a representation of a force that displays both the direction and the quantity of that force.

Abbreviations used in this chapter include:

α	-	angle of attack
CG	-	center of gravity
CL	-	center of lift
FAA	-	Federal Aviation Administration (Dept. of Transportation)
gal	-	gallons
kts	-	knots (1 knot $\approx$ 1.15 miles per hour)
lbs	-	pounds
FPM	-	feet per minute
RPM	-	revolutions per minute
FF	-	fuel flow
M	-	mach (the speed of sound at your current altitude)

The Four Forces

Figure 7.1 illustrates the classic "four forces" of flight and shows the approximate direction in which each force operates.

Lift is the force that tends to pull the aircraft up. Most lift is generated by the wing.

Drag is the resistance of air to an object passing through it. The direction of this force is exactly opposite to the direction of object movement.

Weight is a function of gravity. This force is directed straight down toward the center of the earth.

Thrust is the force developed by your engines, and is directed forward.

Lift

Lift is created by the wing passing through air. A cross-section of the wing (airfoil) is shown in Figure 7.2, where some important terms are introduced.

The mean chord line is an imaginary line that extends from the leading edge to the trailing edge of the airfoil. Relative wind is the airflow caused by passing the aircraft through an airmass. Relative wind is approximately opposite to the flight path. Angle of attack (α) is the angle between the relative wind and the mean chord line. Figure 7.3 illustrates these terms in level, climbing and descending flight.

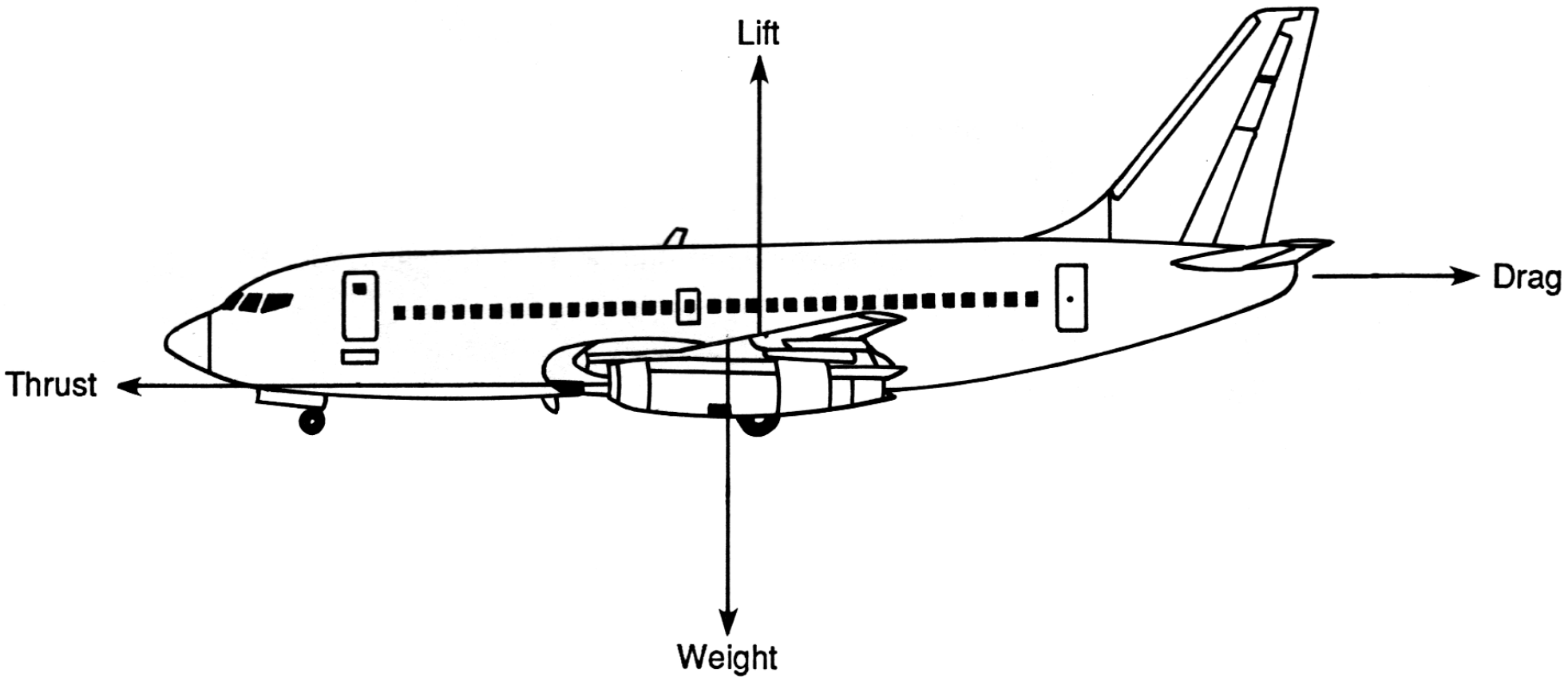


Figure 7.1. Four Forces of Flight

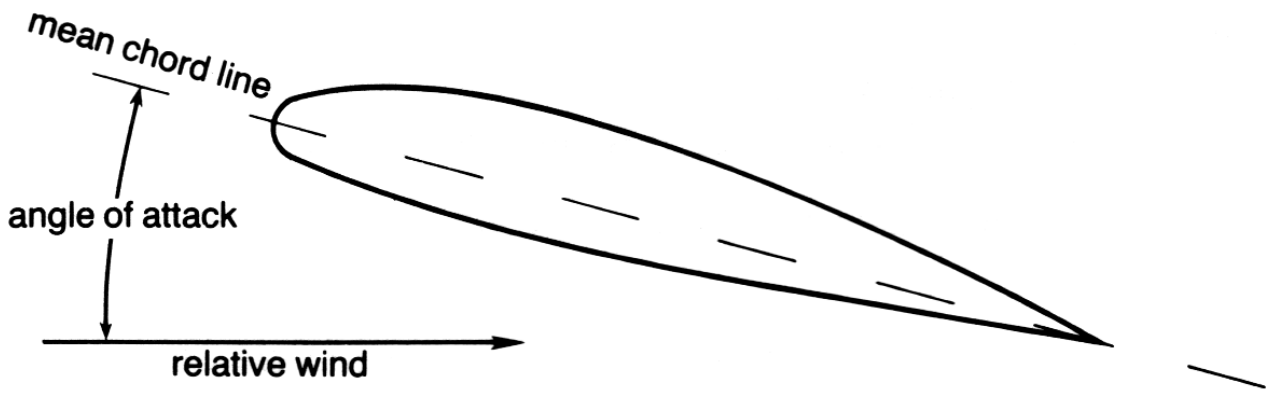
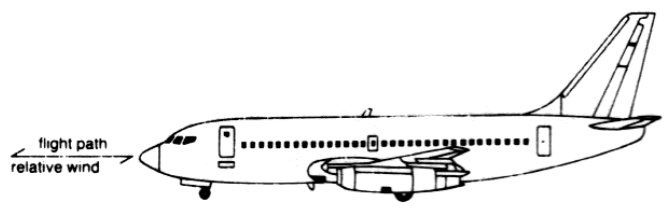


Figure 7.2. Airfoil Terminology



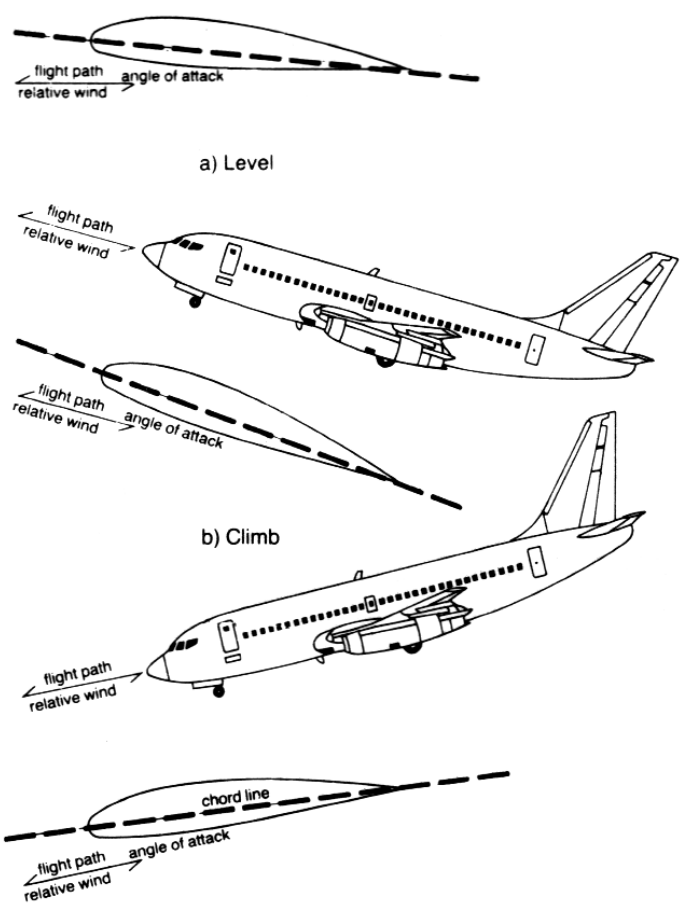


Figure 7.3. Angle of Attack

Note that angle of attack does not have the same meaning as aircraft pitch attitude. The angle of attack is purposely the same in all three examples (level, climbing and descending flight) in order to emphasize this difference. In actual flight your angle of attack is often different during different phases of the flight.

In order to understand how lift is produced, we must explore the theories of Bernoulli and Newton.

Bernoulli addressed the conservation of energy in fluid flow. Assuming a constant fluid density (no compression), energy is held constant by decreasing pressure with increasing velocity or, conversely, by increasing pressure with decreasing velocity. This incompressibility assumption holds nearly true for airflow as well. The classic graphic illustration of this principle usually depicts a tube of varying diameter (see Figure 7.4).

Figure 7.4 shows an enclosed tube with airflow. Mass flow within the enclosed tube is the same at all points since the air cannot escape. An incompressible fluid must increase velocity at the narrow point to maintain mass flow. If energy is to be conserved, then an increase in velocity (kinetic energy) must be balanced by a decrease in pressure (potential energy).

Figure 7.5 illustrates airflow past an airfoil at a positive angle of attack. The airflow over the top of the wing has a higher velocity than the airflow under the wing and, consequently, a lower pressure. A basic rule in physics states that when an imbalance exists, a force will result tending to relieve that imbalance. In the case of an airfoil this force is directed upwards, from the higher pressure to the lower pressure. This force is known as lift.

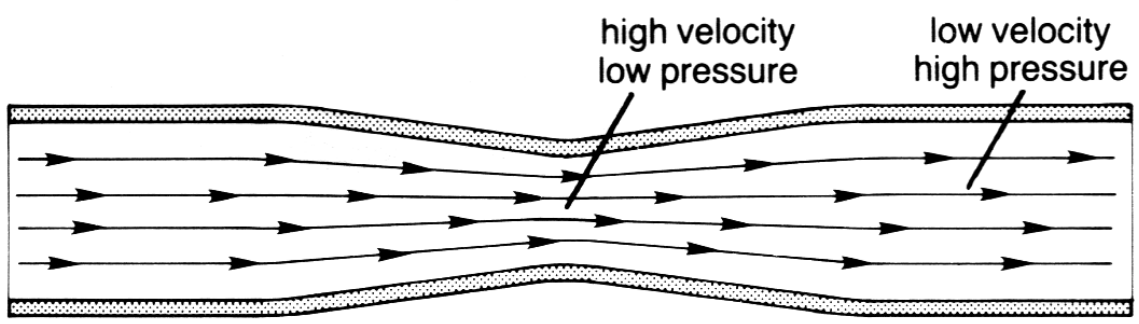


Figure 7.4. Bernoulli's FavoriteTube

The Bernoulli Controversy

As late as the mid 1960s, most flight instructors were emphasizing Bernoulli's law as the major contributor to lift theory. This concept does go a long way in illustrating lift when looking just at airflow immediately adjacent to the wing. Bernoulli's law, however, doesn't adequately illustrate the forces of airflow deflected by the wing. Indeed, most instructors today give credit to Newton for explaining the majority of lift production.

Newton's third law states that for every action there is an equal and opposite reaction. Figure 7.6 is a repeat of Figure 7.5 with labels changed to emphasize action-reaction theory.

Downwash is caused by the airfoil altering the direction of airflow downwards. This will occur as long as there is a positive angle of attack. Downwash is easy to understand no matter what shape the airfoil takes. In an age when fighter jets use thin, symmetrical airfoils, it is easy to see why deflected air is used to help visualize lift generation.

Controlling Lift

As a pilot, you must learn how to control lift during takeoff, climbs, level flight, turns, descents and landing. You can generally increase lift in two ways; increase airspeed or increase your angle of attack.

Given a constant angle of attack, an increase in airspeed increases pressure differential and downwash, thereby increasing lift. Given a constant airspeed, an increased α increases pressure differential and downwash, again increasing lift. As a pilot, you must

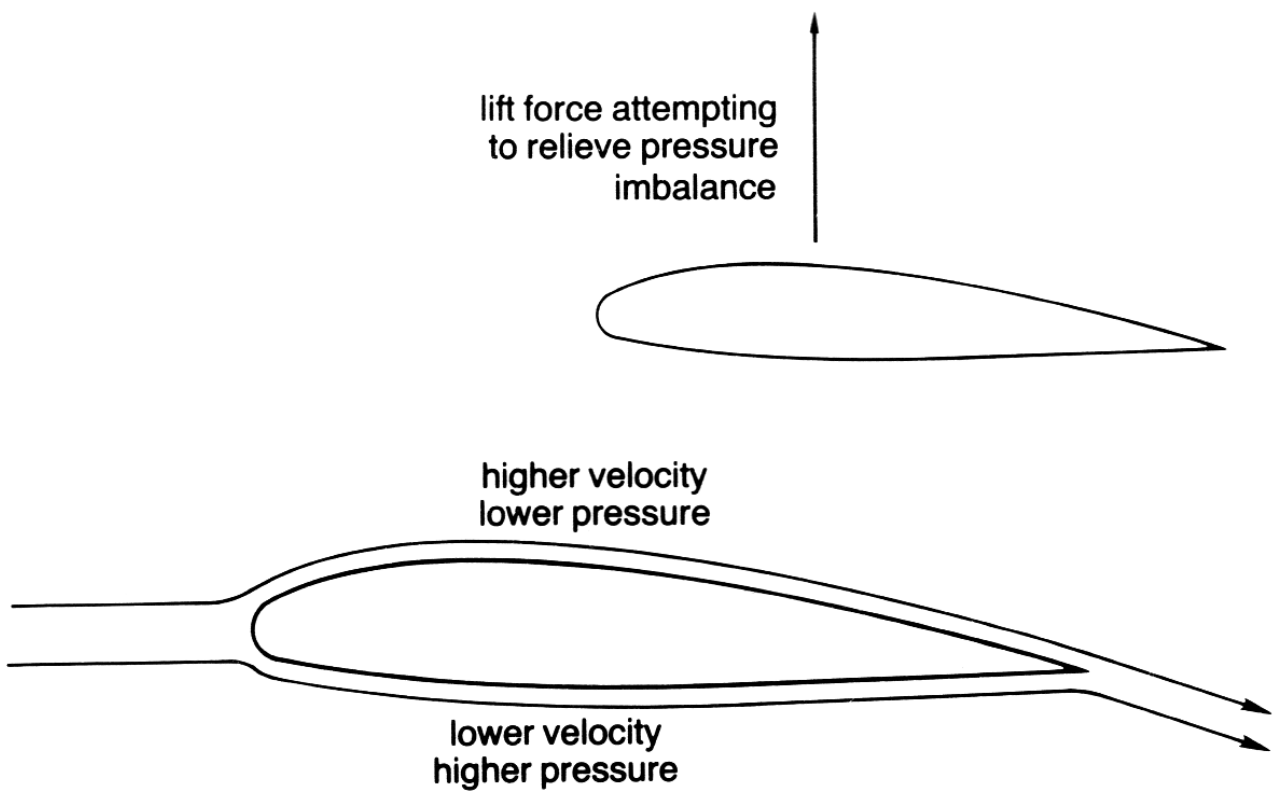


Figure 7.5. Bernoulli's Explanation of Lift

manage both airspeed and α in order to achieve the desired flight goals. A good example is the airspeed transition from fast cruise flight to slower flight when beginning a landing approach. You reduce thrust and the aircraft decelerates. Since the weight of your aircraft is unchanged, you must produce constant lift during the deceleration. In order to produce constant lift, you must slowly increase the angle of attack until the aircraft is stable at its new slower speed.

The Stall

There is a limit to the angle of attack that you can use to generate lift. You can alter the relative wind airflow only so far before the wind refuses to change anymore.

Figure 7.7 shows an airfoil at three different angles of attack. The top illustration shows an airfoil at the same α as discussed in the previous section on lift generation. The middle airfoil shows an increased α. Notice that the airflow is separating from the surface near the upper trailing edge of the wing. The bottom airfoil is at stall α. The point of airflow separation is so far forward that we don't even see a downwash vector; Newton's downwash is gone. Velocity in the area aft of the separation point is very low; Bernoulli's suction is gone. And with neither law still in effect, there is no way to maintain lift.

IMPORTANT NOTE: What is a stall? A sudden loss of lift due to airflow separation from the wing. How do you stall an airfoil? Stall is a function of angle of attack. You can stall an aircraft at any airspeed and pitch attitude if you exceed the stall angle of attack. How do you recover from a stall? Simply reduce the angle of attack.

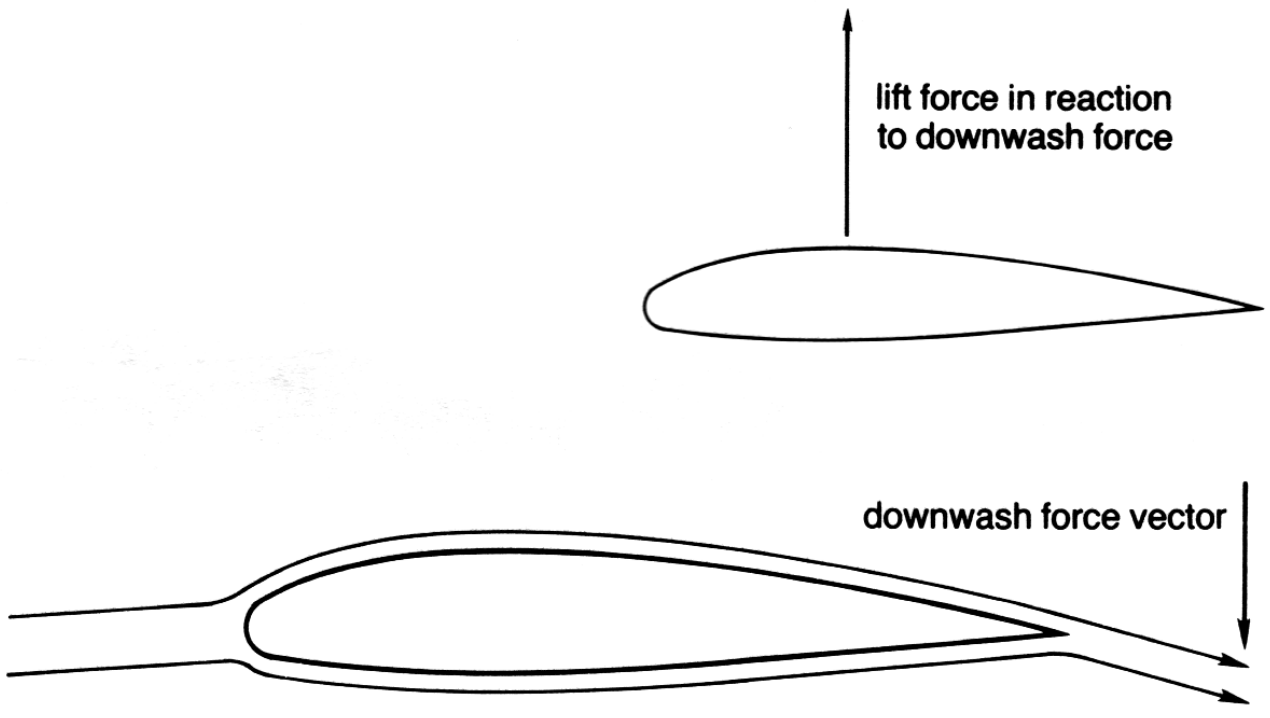
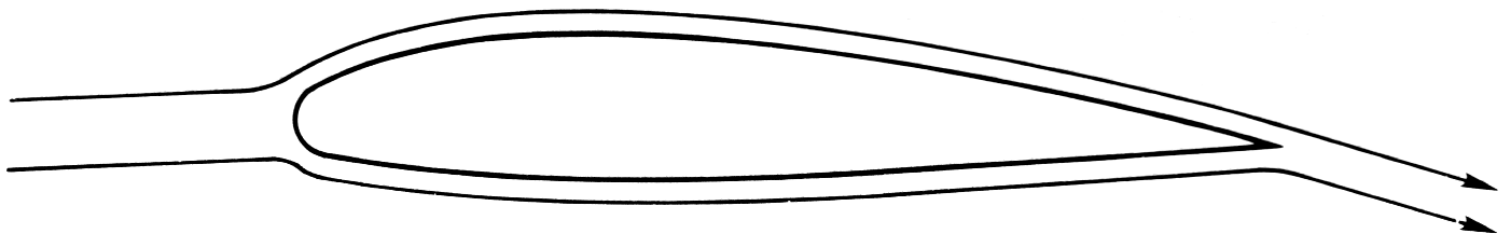


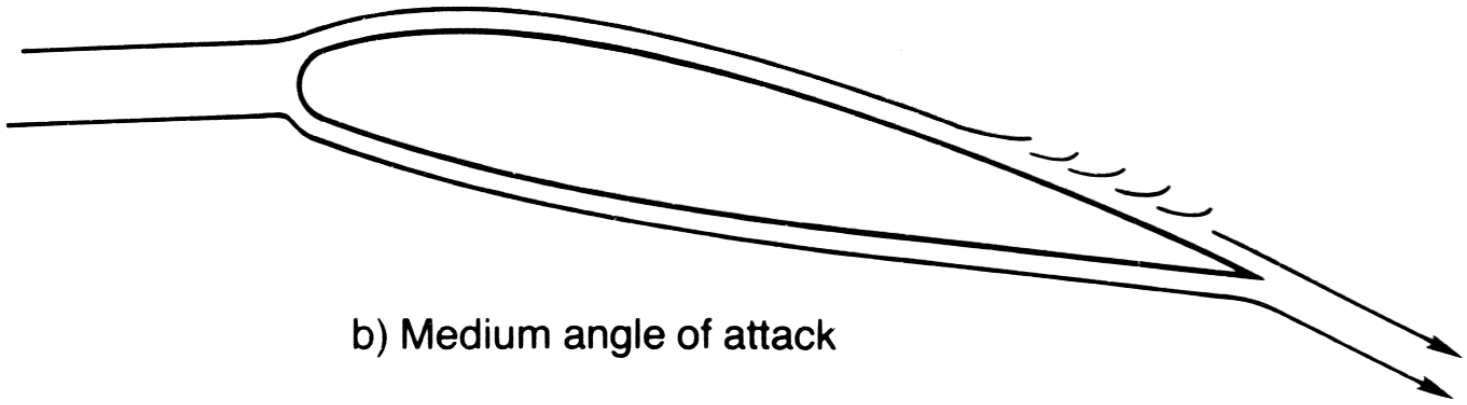
Figure 7.6. Newton's Explanation of Lift

Stall angle of attack depends on the airfoil shape, and is usually somewhere between 10° and 20°. Generally speaking, thin airfoils will stall at a lower α while thick airfoils will stall at a higher α. Also, symmetrical airfoils will stall at a lower α than airfoils with more bulge on the upper surface (higher camber). Figure 7.8 shows the lift characteristics of a typical airfoil. Lift increases steadily until stall angle is reached. After this point it drops off suddenly.

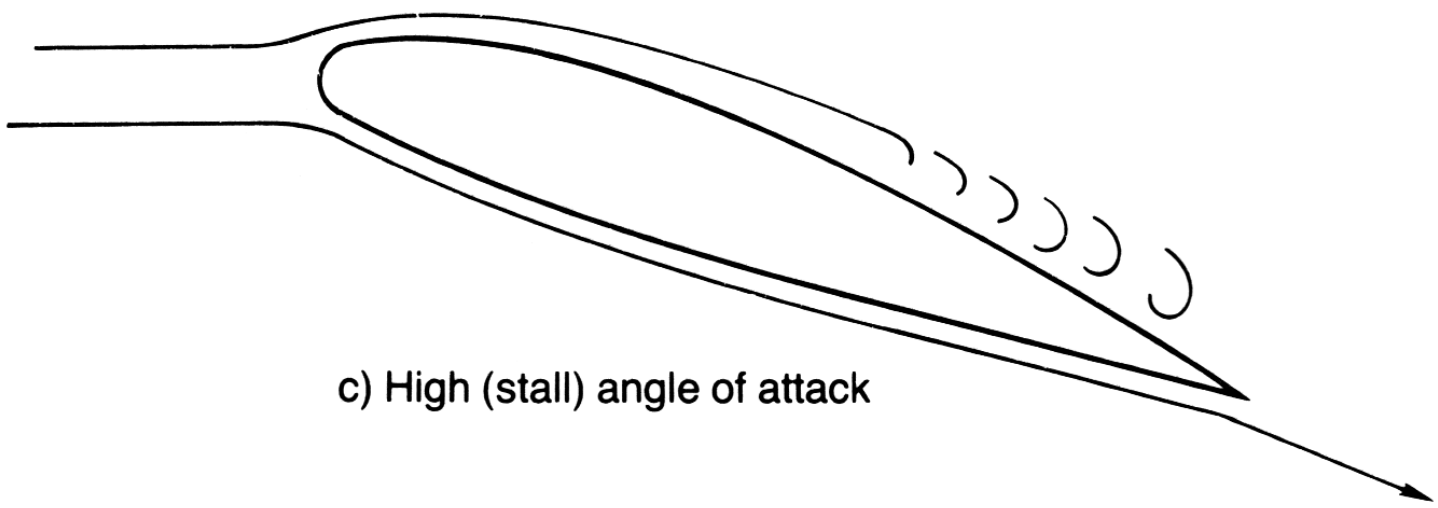
As you can see, lift is a very important factor in flight. We will return to it often when discussing aircraft control, and will even touch on it during the following discussion of drag.



a) Low angle of attack



b) Medium angle of attack



c) High (stall) angle of attack

Figure 7.7. Airflow Separation with Increasing Angle of Attack

Drag

We have already described drag as a resistive force to the movement of the aircraft. By this definition, drag will always act along a line opposite the aircraft's flight path.

There are two types of drag that warrant separate coverage. The first is parasitic drag, that drag caused by the physical aircraft displacing and rubbing the airstream. The second type is induced drag, an unusual phenomenon peculiar to aircraft. Induced drag is a byproduct of the generation of lift.

Parasitic Drag

You are already familiar with the parasitic drag encountered, for example, when driving a car. Parasitic drag caused by air displacement is called form drag. If you view the front end of a car or an airplane and make a filled-in outline of this view, you will see how much form the vehicle has. Streamlining the form can help reduce drag but, assuming good streamlining in all cases, more form means more parasitic drag.

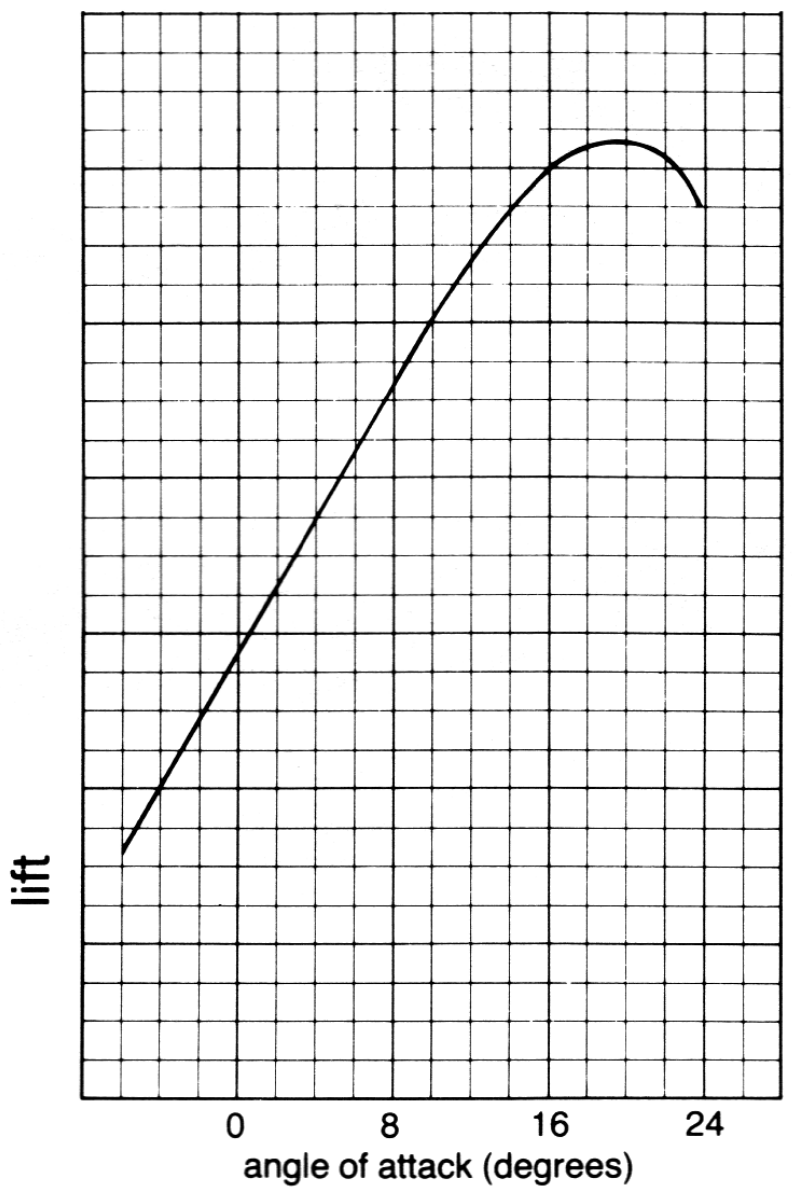


Figure 7.8. Lift versus Angle of Attack

Skin friction is roughly proportional to the amount of surface exposed to the airstream. More surface means more drag.

Parasitic drag increases non-linearly with increasing airspeed. The dynamic pressure of air is a function of the square of the velocity. Assume that you are moving in your car at a speed of 30 mph. If you accelerate to 60 mph you will experience four times the drag. Cruise at 120 mph and the drag becomes sixteen times as great as it was at 30 mph. This fact assumes a great deal of importance when you realize that thrust is needed to overcome drag. At 30 mph your car may require 25 pounds of thrust to sustain speed. At 60 mph you'll need 100 pounds, and at 120 mph you'll need 400 pounds of thrust to sustain speed. A typical parasitic drag vs. airspeed curve is shown in Figure 7.9.

Induced Drag

While creating lift, your airfoil changes the direction of airflow in many ways. You're already familiar with downwash. This downward deflection of air changes the relative wind in the vicinity of the wing to a slightly downward direction. As a result, the true α is different from the apparent α derived from the relative wind opposite the flight path.

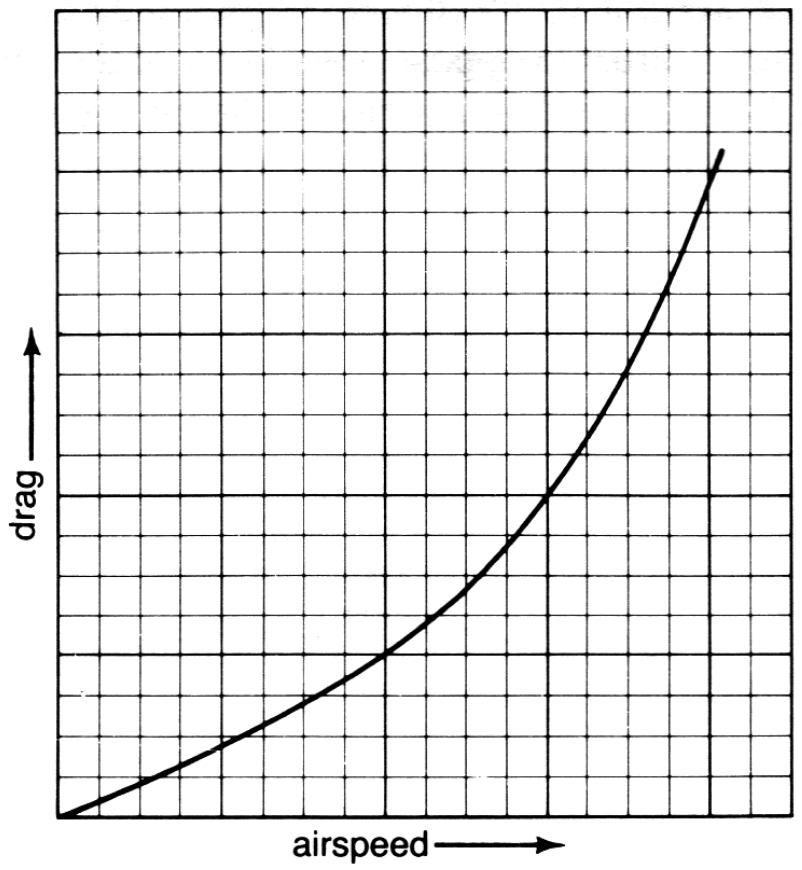


Figure 7.9. Parasitic Drag versus Airspeed

Lift is produced perpendicular to the relative wind direction. A relative wind in a slightly downward direction will give us a real lift vector with a component toward the rear. This rearward component is known as induced drag. Figure 7.10 illustrates the concept of induced drag.

The induced drag vector is increased when the angle of attack increases. Given that weight, bank angle and other factors are held constant, a slower airspeed demands a higher angle of attack to produce the same lift. Therefore, the slower the airspeed, the greater the induced drag. Figure 7.11 shows a graph of induced drag vs. airspeed. Note that it is non-linear. As velocity decreases, induced drag increases inversely proportional to the square of the velocity. This phenomenon can be explained when you remember that dynamic pressure from the airstream increases as the square of velocity. Greater dynamic pressure means more lift production capability. Drop your airspeed by one-half and you only get one-quarter the lift production capability. Therefore, you will need quite an increase in α to produce the same lift, and induced drag also will increase dramatically.

Total Drag

Total drag equals parasitic drag plus induced drag. Figure 7.12 shows both parasitic and induced drag on the same graph. Total drag is simply both types of drag added together vertically on the graph.

This graphically-illustrated concept of total drag is important for proper aircraft control. Since you need thrust to oppose drag, think of the vertical axis as required thrust rather than drag. You'll note that at airspeeds below the minimum drag point, more thrust is needed to sustain level flight than at the minimum drag point. Flying at airspeeds below the minimum drag point can cause problems for the novice pilot.

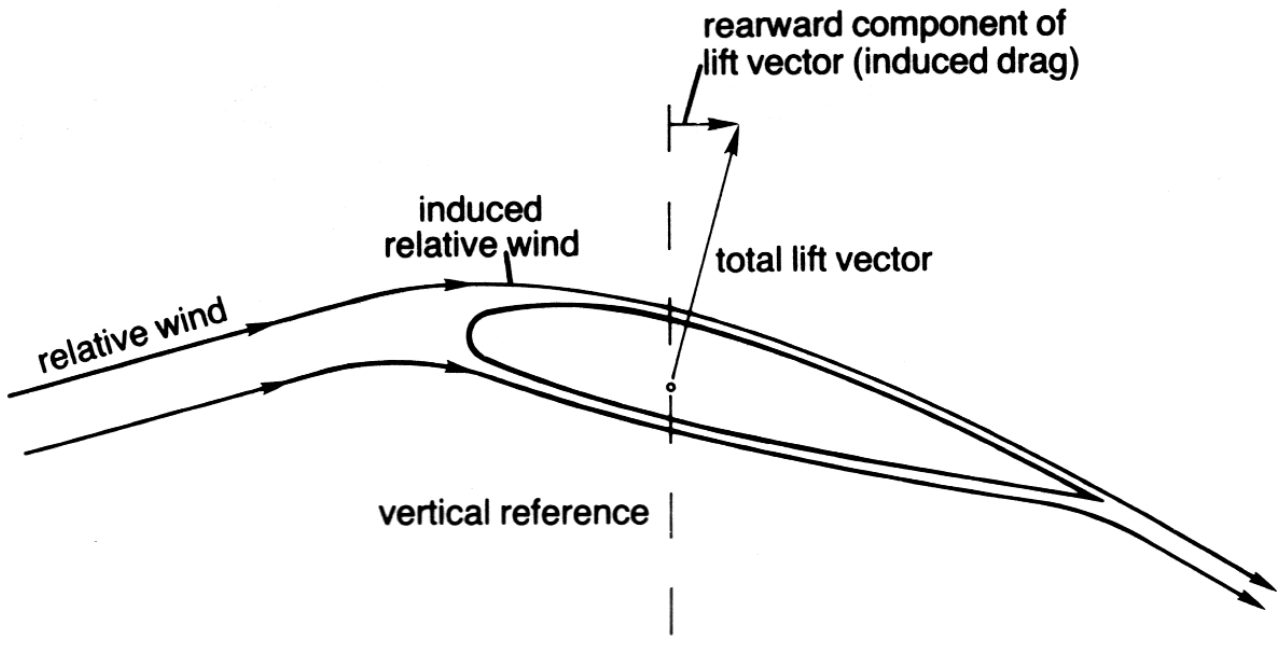


Figure 7.10. Induced Drag due to Induced Relative Wind

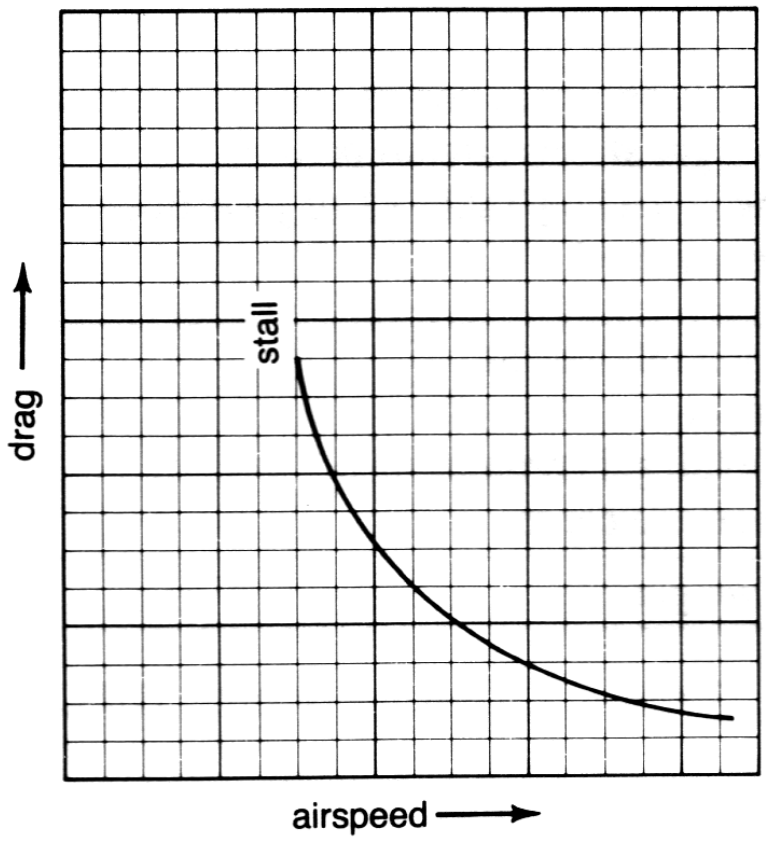


Figure 7.11. Induced Drag versus Airspeed

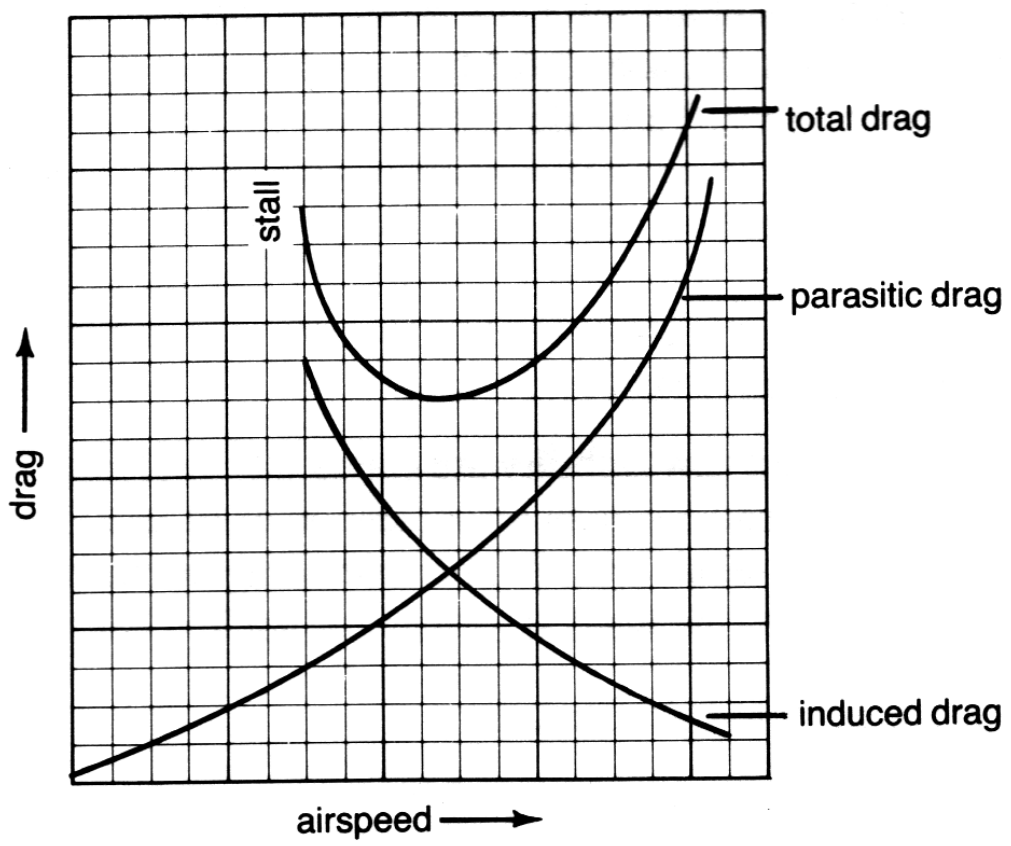


Figure 7.12. Total Drag versus Airspeed

Weight

Weight is an obvious concept to understand. Passengers, baggage, fuel and oil all have weight, and this weight affects aircraft performance since more lift is required to carry more weight. Look at loading Table 7.1 of your Boeing 737 to get an idea of how much weight and lift are involved.

Basic aircraft weight	60,000 lbs.
Passengers	17,000
Fuel (4480 gal kerosene @ 6.7 lbs/gal)	30,000
Baggage and cargo	3,000
Total weight	100,000 lbs

Table 7.1. Loaded Boeing 737-250 Weights

Thrust

Thrust is created by your engines and is indirectly indicated by the engine pressure ratio (EPR = engine exhaust vs. inlet pressure) and RPM of the spinning turbines. We will simplify your task of thrust management by having you quantify thrust in terms of fuel flow (FF). Assume that for every lb/hour of fuel flow you get 1.4 lbs of thrust.

Stability

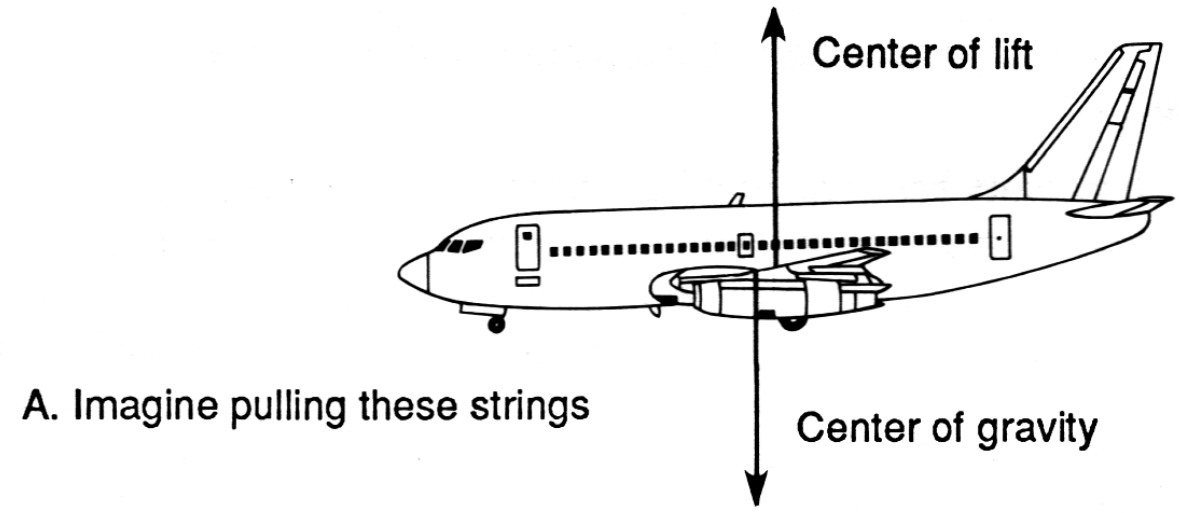
Stability in terms of aircraft control defines the ability of an aircraft to return to a normal-state attitude, unassisted by the pilot, after it is displaced from the normal state. If you change aircraft attitude and the aircraft maintains that attitude when you let go of the controls, you've encountered neutral stability. Negative stability is experienced if you change attitude and the attitude continues to change in the same direction after you've let go of the controls. Finally, if the aircraft is in a steady state and your controlled displacement is followed by the aircraft's return to its original state, you've experienced positive stability.

Aircraft pitch and yaw stability are classically explained by comparing the aircraft to an arrow. The tail feathers of an arrow tend to exert increased pressure if the arrow is not aligned with the relative wind. This extra drag on the rear of the arrow causes the arrow to align itself with the wind as pressure is applied behind the center of mass.

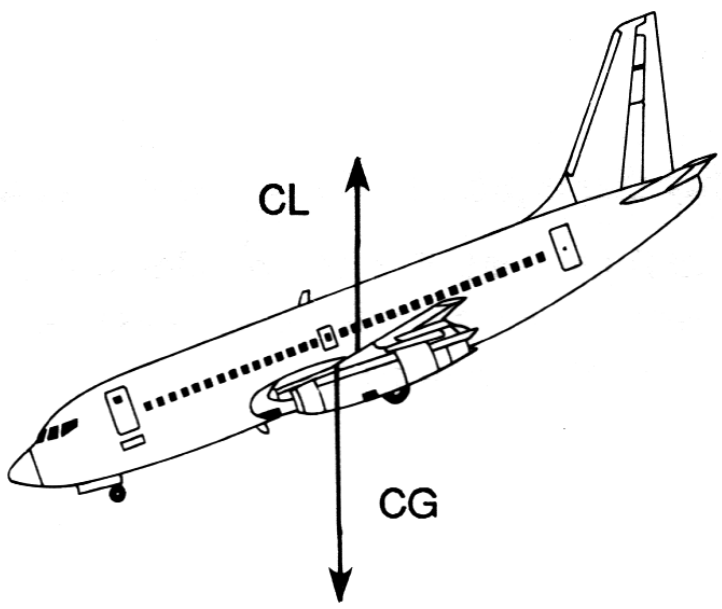
Balance and Pitch Stability

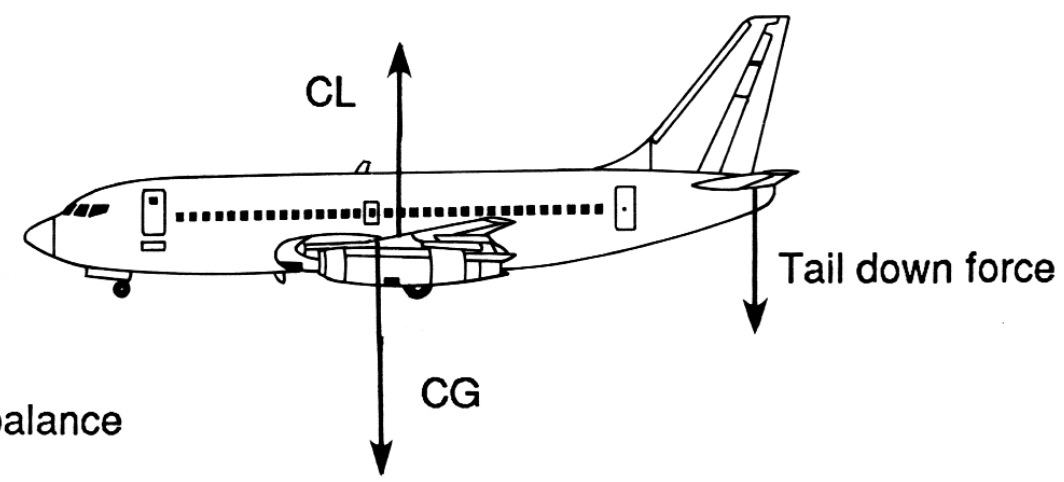
For safety reasons, aircraft must demonstrate positive pitch stability before they can be certified. Correct balance ensures positive pitch stability, at least in the static (one point in time) sense. If your loaded aircraft's center of gravity is ahead of the center of lift, the aircraft usually has positive static pitch stability. This is because center of lift roughly equates to center of pressure (as per the arrow example).

More important than this (very condensed) discussion of stability is the consequence of pitch stability on aircraft control. Figure 7.13 shows a stable loading condition, with the aircraft's center of gravity ahead of its center of lift. Imagine that the CG and CL vectors are strings; pulling them would cause the aircraft to pitch down. In fact, tail down force is needed to keep the nose from dropping. This tail down force is present during most of your flights.



A. Imagine pulling these strings





B. Tail down force balance

Figure 7.13. Stable Loading Condition

The application or removal of thrust has an interesting effect as a result of this balance. As thrust is increased (assuming that you only change throttle, not elevator), the initial increase in airspeed then increases tail down force, lifting the nose until the old balance is maintained. The net result is that the aircraft begins to climb at approximately the old airspeed. Similarly, as thrust is reduced, the nose drops but equilibrium airspeed remains nearly the same.

Thrust or pitch changes cause a momentary imbalance in tail down force vs. the CG-CL twist. With no further interference, the aircraft will oscillate about the new equilibrium pitch attitude.

Positive pitch stability has great implications for easy aircraft control. Understanding the stable-pitch nature of aircraft will help you avoid over-reacting with pitch control. Figure 7.14 illustrates aircraft pitch oscillations assuming positive dynamic stability. Pilot over-reaction in pitch is usually caused by over-enforcing pitch changes in the direction that your aircraft wants to pitch anyway. Good pilot reaction involves a knowledge of these oscillations, and requires application of pitch control opposite to the natural direction a bit before the aircraft passes through the desired pitch attitude.

Roll Stability

Positive roll stability is minor (when it exists) but, like pitch stability, a knowledge of the roll stability that is present will help with your aircraft control.

To ease aircraft flight control, ATP provides slightly positive roll stability at any bank angle; this means that the aircraft will always tend to roll level out of a bank with no control displacement on your part.

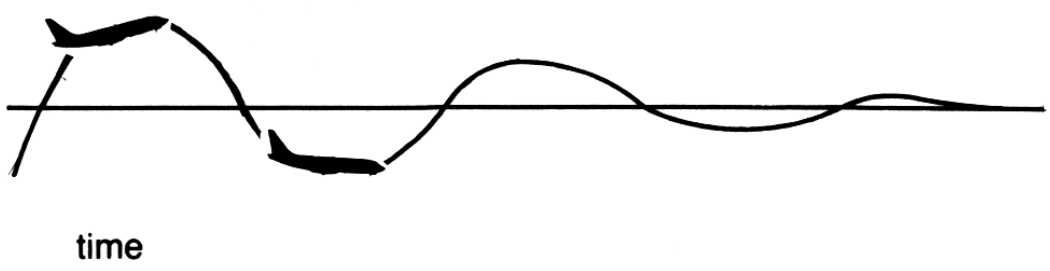


Figure 7.14. Positive Dynamic Pitch Stability

Flight Controls

Flight controls allow you to change the aircraft's orientation about the pitch, roll and yaw axes as well as change the amount of thrust and drag on the aircraft. All flight controls obtain force through air deflection. An example of air deflection is the down-wash previously described in the lift section. The principles of deflection that induce lift transfer to our discussion of flight controls, except that in this case orientation of the control surface may cause local upwash, downwash or sidewash.

The principles of air deflection are very straightforward. Figure 7.15 shows deflection of air by a vertical control surface mounted on the rear of the aircraft, the rudder.

Principles of lift apply to control surface wind deflection, and the effects of velocity are worth reviewing. Remember that the dynamic pressure of air is a function of the square of velocity. You can't expect aircraft control from control surfaces at zero airspeed. You'll experience sluggish control response at slow airspeeds, and good response at high airspeeds.

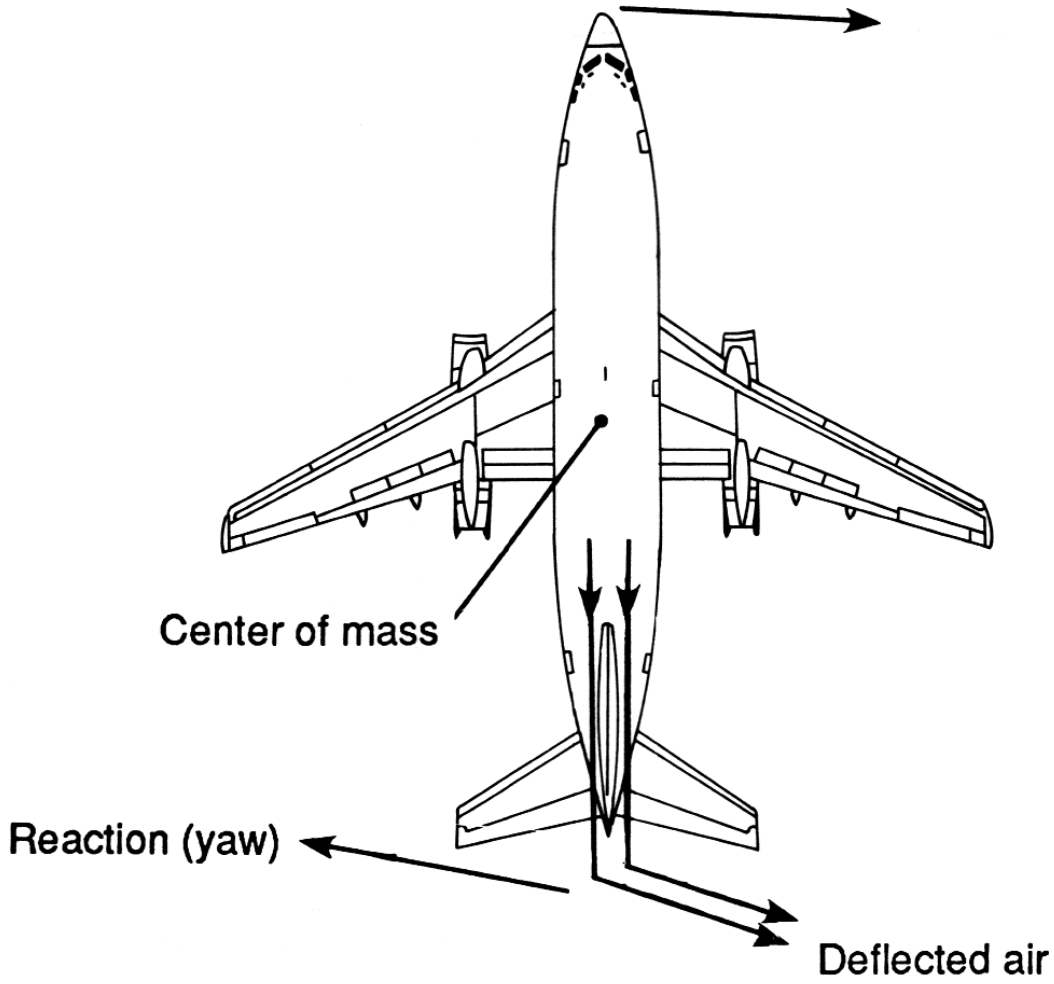


Figure 7.15. Deflection of Air by the Rudder

Physics of Aircraft Control

Pitch Control

Assume that your aircraft is flying at a constant altitude at cruise thrust. Each of the four forces balance the others perfectly.

Climb

Increased back pressure on the control yoke (up elevator) causes the aircraft to pitch up. Initially, the increased angle of attack results in excess lift causing an acceleration upward. The aircraft is now, in effect, going uphill. This extra work will slow the aircraft to the point where all forces again balance, and the aircraft will be in an unaccelerated climb. Climb rate at this new equilibrium depends on available thrust and pitch attitude. This concept is illustrated in Figure 7.16.

Note that in a steady-state climb, thrust must balance both drag and the component of weight opposing the climb. In other words, the amount of thrust in excess of that needed to balance drag will determine the climb performance of the aircraft. When all factors except thrust are held constant, more thrust means more climb performance.

Summarized simply, back pressure on the control yoke (up elevator) causes the aircraft to pitch up, gain altitude, and lose speed.

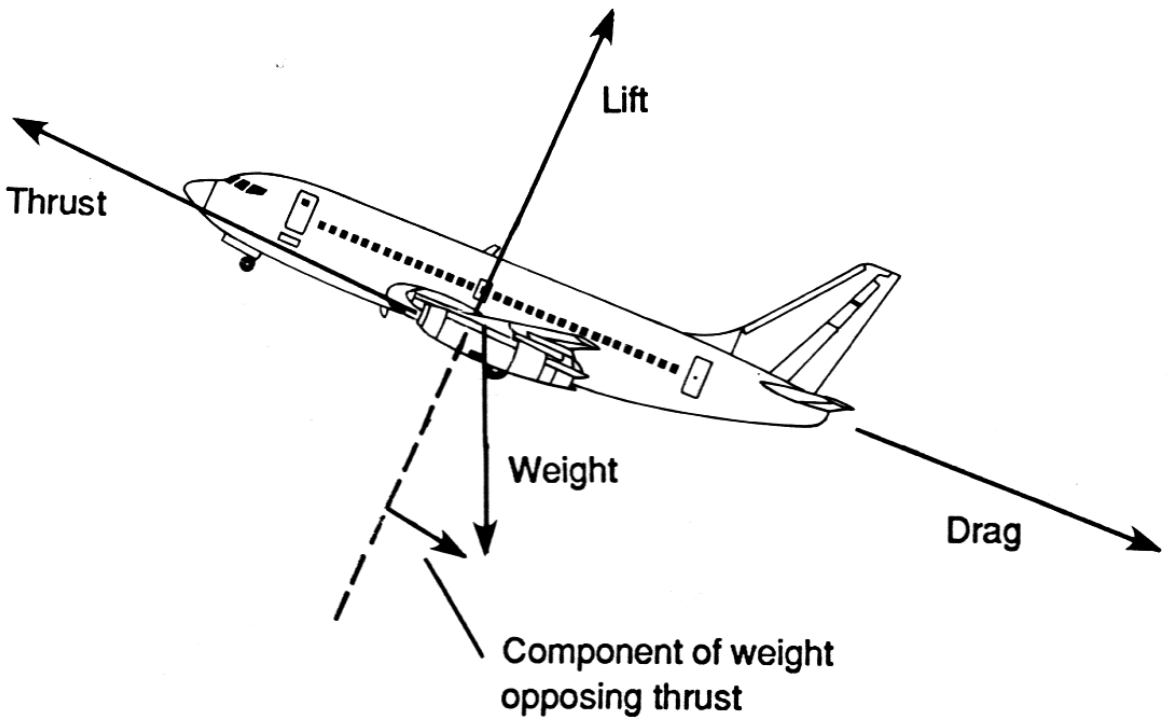


Figure 7.16. Steady Climb: Thrust = Drag + Component of Weight Opposing Thrust

Descent

Forward pressure on the control yoke (down elevator) causes the aircraft to pitch down, lose altitude, and speed up. Analysis of the descent is similar to that of a climb, except that some effects work in reverse. The equilibrium point will occur at an airspeed where drag equals thrust plus the component of weight aiding thrust (see Figure 7.17).

Note that in our discussion of climb and descent, both climb rate and speed are emphasized. Pitch control can be used to vary either altitude or speed.

Roll Control

Roll control changes the bank angle of the aircraft. Application of left or right rotating pressure on the control yoke (left or right aileron) causes the aircraft to roll in the same direction as the application. Releasing pressure on the yoke (centering the aileron) stops the roll and maintains the bank angle obtained when the pressure was released.

An aircraft in a bank will turn (change direction). The cause of this turn is illustrated in Figure 7.18. The horizontal component of lift will pull the aircraft, and the aircraft will change heading in the direction of this pull.

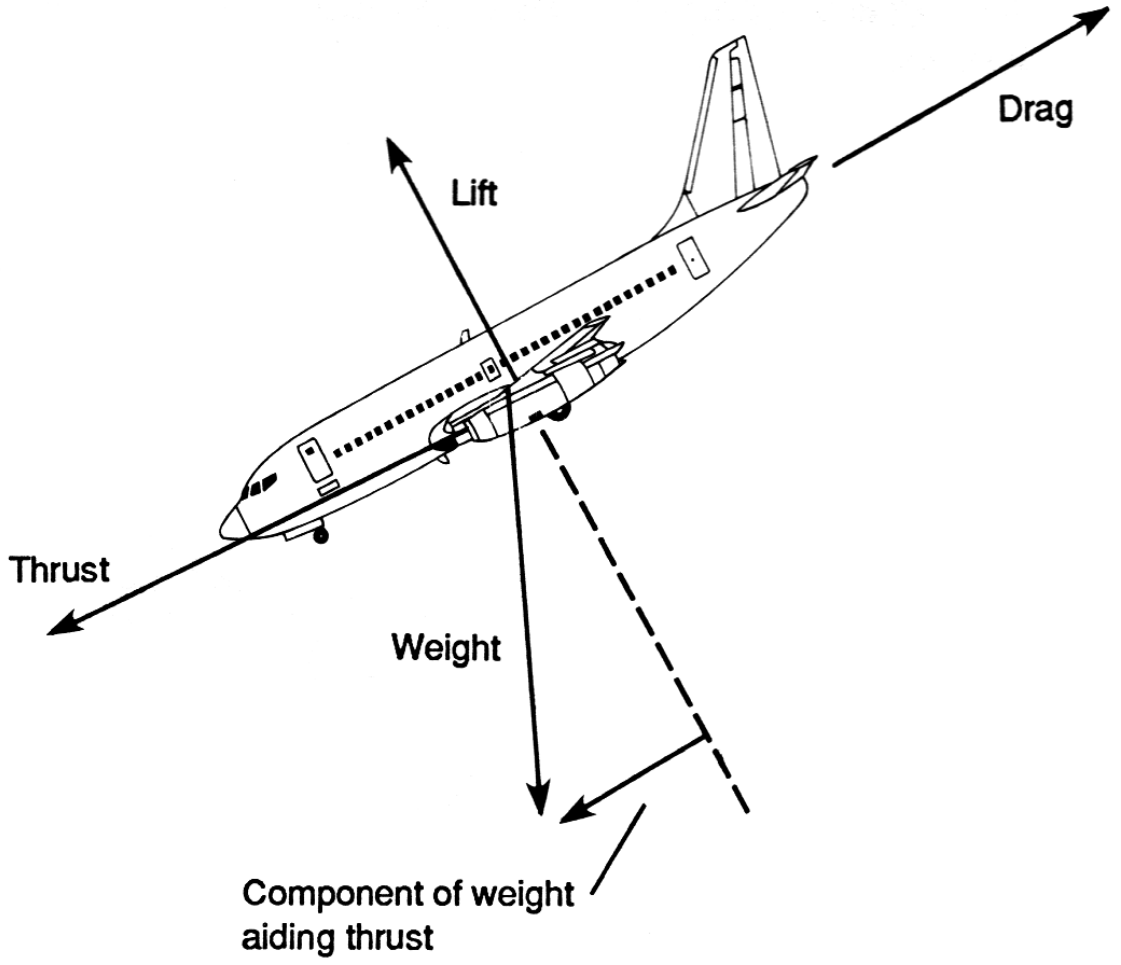


Figure 7.17. Steady Descent: Drag = Thrust + Component of Weight Aiding Thrust

A full explanation of the turn is really a bit more complicated than this. As the banked aircraft begins to change its direction of movement, the nose is still pointing (at least momentarily) in the original direction of movement. The tail and other surfaces begin to act like the feathers on an arrow; the aircraft's nose changes direction as the aircraft constantly re-aligns itself into the relative wind.

Let's stop and summarize. You know that pitch can control altitude or speed. Roll is used to control heading (or change in heading).

Yaw Control

Rudder application causes rotation about the vertical axis. Assuming that all other control inputs are held constant, the application of rudder causes a change in relative wind along the longitudinal axis.

During most aspects of flight, the purpose of yaw control is to keep relative wind aligned with the longitudinal axis. When the auto-coordination option in ATP is turned on, the program applies rudder for you automatically. Therefore, this alignment will be of little concern to you during your initial flights.

Drag (and Lift) Control

Generally speaking, the first few flap settings mostly increase lift, while the last flap settings add mostly drag. Flap operations will be discussed in the Chapter 8 flight lessons.

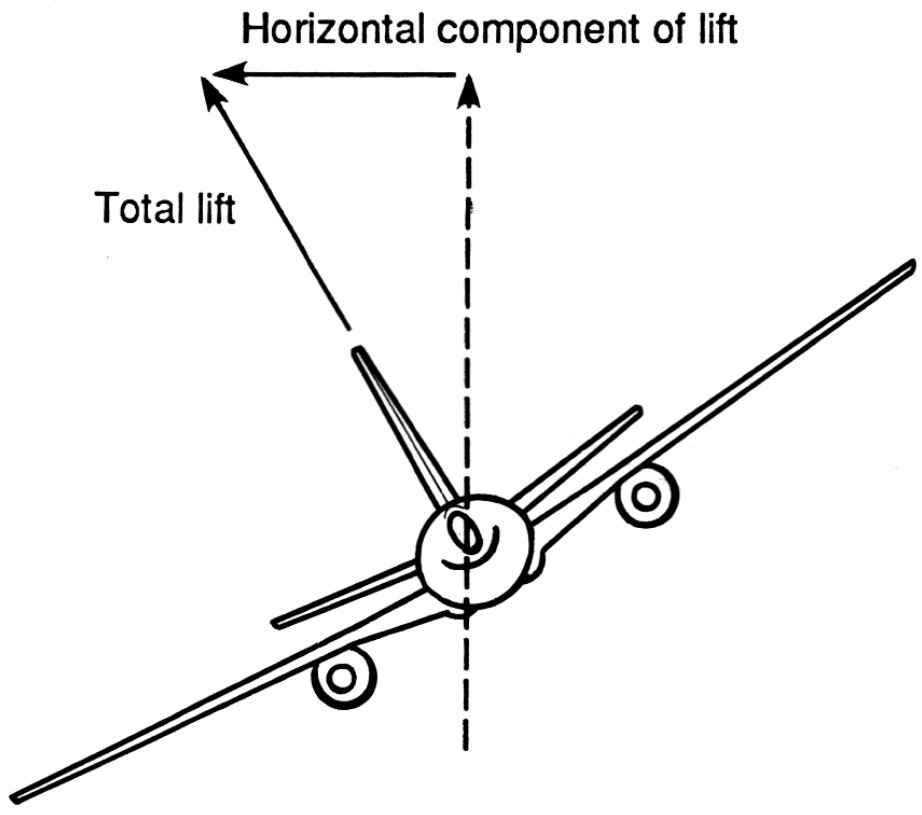


Figure 7.18. The Turn

Thrust Control

Three or more measures of thrust control are used for turbine engines; EPR (engine pressure ratio), and the RPM of one or more stages of rotors (N_1, N_2, etc.) are noted as limits for critical regimes of engine operation. For the purpose of this simulation, we will simplify thrust control to terms of fuel flow (FF), which translates rather directly into thrust.

Assuming that you are in unaccelerating straight and level flight, an increase in thrust will cause the aircraft to nose up. This nose-up tendency is a result of the aircraft's pitch stability discussed previously. Increased dynamic pressure causes extra tail down force. If you do not counteract this tendency by applying down elevator, the nose will rise to a new equilibrium point and you will climb at an airspeed similar to the level flight airspeed. The effect of stable tail down force means that a reduction in thrust without a change in pitch control will allow the tail to rise (and nose to lower). Again, the aircraft will descend at close to level flight airspeed rather than stay level at a reduced airspeed.

In summary, thrust's effects on airspeed go contrary to many preconceived ideas regarding thrust use. A change in thrust must be counteracted by an adjustment in pitch pressure in order to achieve the main level flight use of thrust, i.e. airspeed control.

Terminology of Flight Goals

As you learn flight maneuvers, you will be given goals to achieve in altitude, heading (direction), airspeed and, often, vertical speed. The proper achievement of these goals can be measured on flight instruments as well as through outside viewing.

Altitude

Altitude goals are described in terms of MSL, FL, or AGL. MSL (for mean sea level) is the height above sea level as read on your altimeter. Airport and many surface and obstruction heights are given in MSL. At lower altitudes, therefore, you will be given MSL altitude assignments. Correction factors may be applied to obtain an accurate altitude in MSL, but the only one that you will be concerned with will be to apply a local altimeter setting to your altimeter. This will be given in inches of barometric pressure adjusted to sea level. One half inch of pressure change (common during long flights) can cause your altimeter reading to be off by as much as 500 feet, a serious problem during landing approaches in poor weather.

Above 18,000 feet you will use FLs, or flight levels. At these altitudes collision with the ground is possible only in the highest mountains. All aircraft flying at the flight levels set the standard 29.92 inches of barometric pressure on their altimeters so as to have a standard reference in vertical clearance from each other. When descending

through 18,000 feet, you must reset your altimeter to the local barometric pressure to use MSL heights. FLs are denoted like other altitudes, but the hundreds digits are dropped. FL190, FL240 and FL350 are close to 19,000, 24,000 and 35,000 feet.

AGL stands for above ground level, and is useful as an assigned altitude when maneuvering with respect to the ground. Usually you will compute and assign yourself an MSL altitude based on ground elevation plus an AGL assignment. For instance, you should normally fly a visual pattern at 1500 feet AGL. You must compute your ideal altitude by adding 1500 to the MSL field elevation.

Heading

Heading conventions in the 360-degree circle system include 0 or 360 degrees for north, 90 degrees for east, 180 degrees for south, and 270 degrees for west. For practical purposes the trailing zero is omitted from heading for navigation aids shown on maps, and for runway numbers. Note the "compass rose" in Figure 7.19.

Other important heading terminology involves changes in heading. You may be required to turn toward a specific heading, or be asked to change heading by a specified number of degrees. In the latter case, be prepared to apply 360° arithmetic. Important 360° arithmetic concepts to remember are that 90 degrees equals one-quarter of a circle, and 180 degrees equal one-half of a circle. An example turn request could be "make a 90-degree turn to the left".

The heading indicator in ATP is combined with a navigation indicator, in an instrument known as the horizontal situation indicator (HSI).

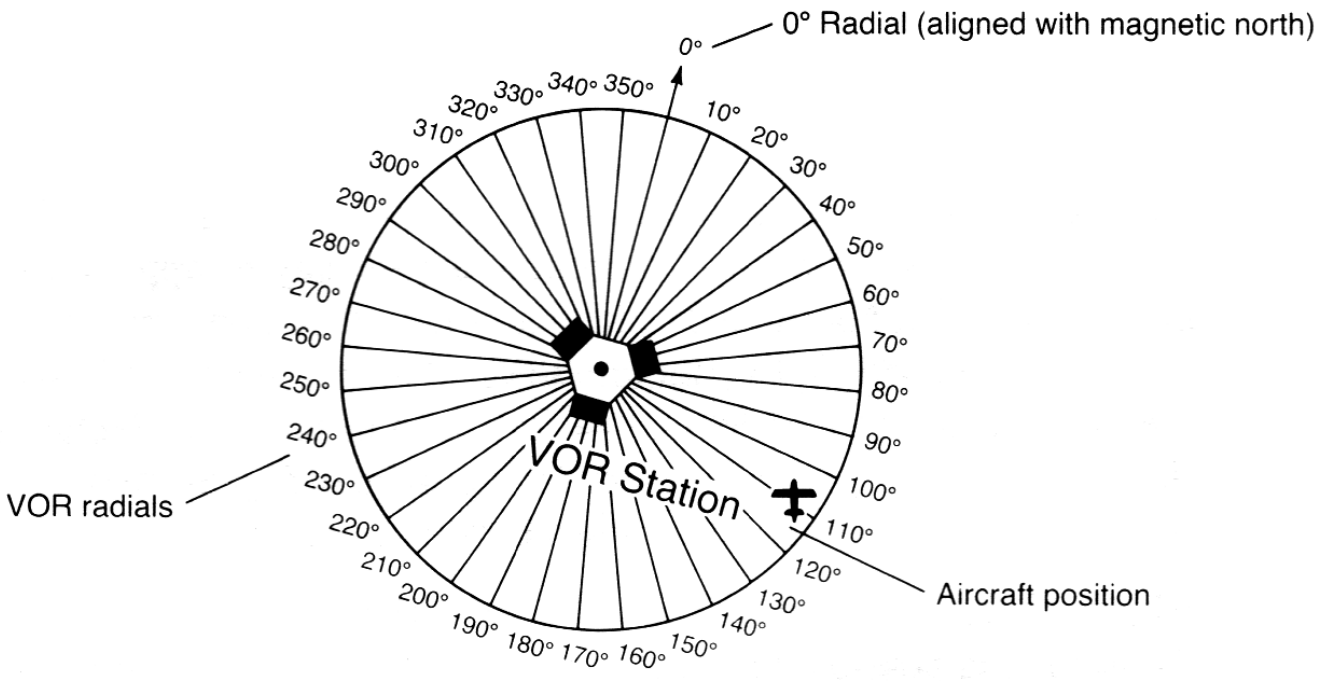


Figure 7.19. Compass Rose

Airspeed and Configuration

The purpose of airspeed information for the modern commercial jet transport pilot differs depending on the segment of flight. The traditional readout of knots (knots x 1.15 ≈ mph) gives useful information during the slower, low-altitude flight maneuvers of takeoff, climb, low-altitude descent and final approach to landing. This airspeed is often read out on a traditional dial indicator.

At low altitudes and low airspeeds this indicator is directly used for aircraft control. Errors may exist, but the same factors that cause airspeed errors also affect the aerodynamics of the aircraft, making indicated airspeed a useful indication of safety margins above stall in the takeoff and landing phases of flight.

The traditional dial-type airspeed indicator gives large errors at higher altitudes and airspeeds. The less dense air results in less physical pressure to give an instrument indication, so you will be traveling much faster than indicated. At 35,000 feet your airspeed indicator reads only 56% of your true airspeed due to this factor. A much smaller but opposite factor, the compressibility of air, causes an overstatement of airspeed. At a calibrated airspeed of 300 kts at an altitude of 35,000 feet, the overstatement is approximately 7%.

At higher altitudes and airspeeds you must use the mach indicator to achieve your flight goals. Mach number expressed as a percentage of the speed of sound (577 kts/633 mph on a standard day at 35,000 feet) varies with temperature, but otherwise gives a stable and rather direct indication of airspeed. Just as indicated airspeed is a useful goal for low altitude, low airspeed maneuvers, mach number is an important goal for high altitude, high airspeed flight. The aerodynamics of the aircraft and the ultimate effect these aerodynamics have on aircraft controllability and structure are limited in terms of mach number.

Along with airspeed assignments, you will often be given a configuration. Configuration refers to the disposition of variable devices attached to the aircraft such as landing gear, flaps and spoilers. Airspeed/configuration goals will often be consistent (standard) for a specific aircraft type and will only apply in combination. An example approach airspeed/configuration is 150 kts, flaps 15 (degrees), and gear down.

Pitch and Bank Attitude

When attempting to change altitude, heading and airspeed, you must alter your pitch and bank attitudes. While the altimeter and horizontal situation indicator can give you a direct reading on your flight goals, you should not make changes in pitch attitude or bank using these instruments. If your goal is to climb, you know that you must raise pitch attitude. To change heading, you must place your aircraft in a bank.

In summary, you understand the aircraft physics of pitch and bank, and know that you effect aircraft performance through changes in pitch and bank. The primary instrument used in pitch and bank control is the attitude indicator.

Summary of Flight Goals

Figure 7.20 shows the flight instruments grouped in a manner consistent with good aircraft control methods.

The division of instruments into goal instruments vs. control instruments is an extremely important consideration. While there may be some argument as to which instruments belong in which group, it must be clearly understood that you do not effect aircraft control through goal instruments but, rather, through the control instruments.

A good example of the problems you can encounter by chasing goal instruments may be found in the case of the pilot who was attempting to advance toward his instrument rating. He had 200 flight hours, including practice at simple instrument approaches.

His technical knowledge of approach procedures was impressive, yet his approaches were poor. He seemed to have problems with basic aircraft control, and couldn't hold altitude within 200 feet of the assigned altitude while in level flight. He was chasing his altimeter.

His flight instructor covered his altimeter, forcing him to use the attitude indicator as a means for altitude control. After several minutes the altimeter was uncovered, revealing a variation of less than 50 feet from initial altitude.

Ironically, his altitude control was good as long as he had no altimeter yet poor when the altimeter was restored. This is what can happen if you don't learn correct basic control. After five hours of proper instruction his aircraft control started to improve. Indeed, his 200 hours of improper aircraft training had developed bad habits which proved nearly impossible to break.

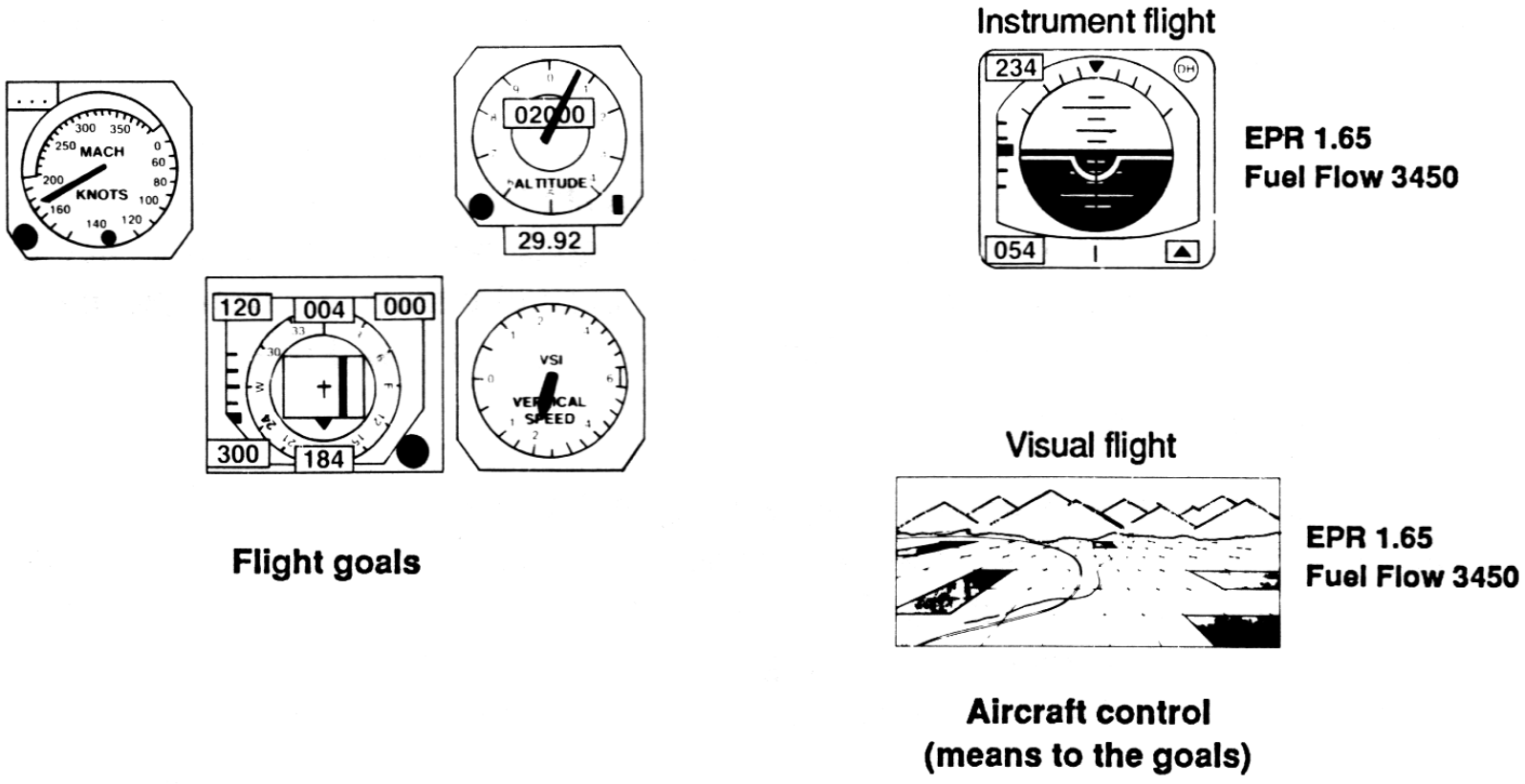
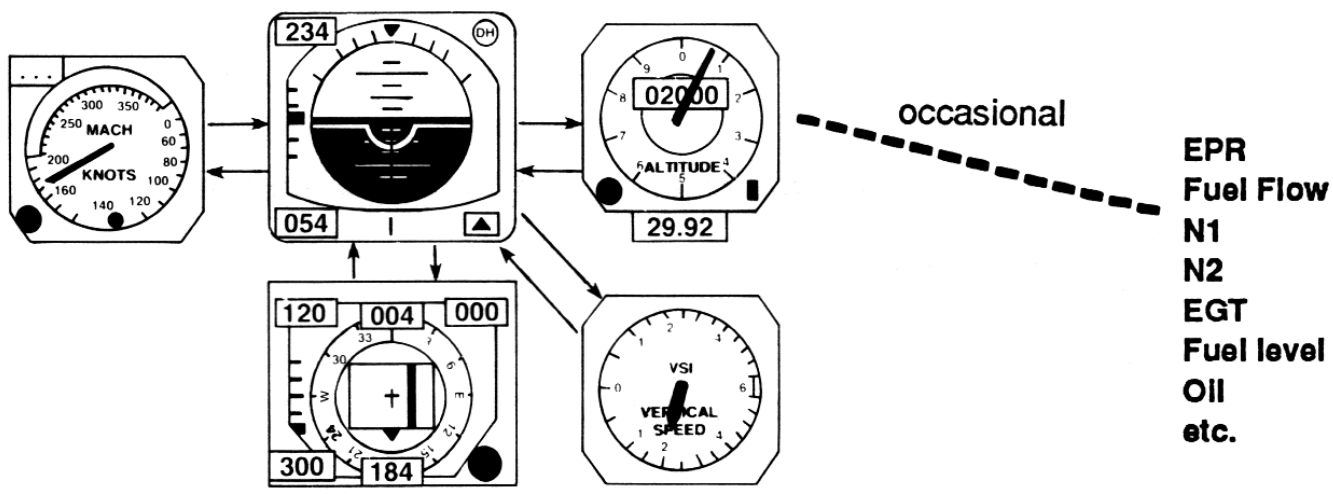


Figure 7.20. Goal versus Control Instruments

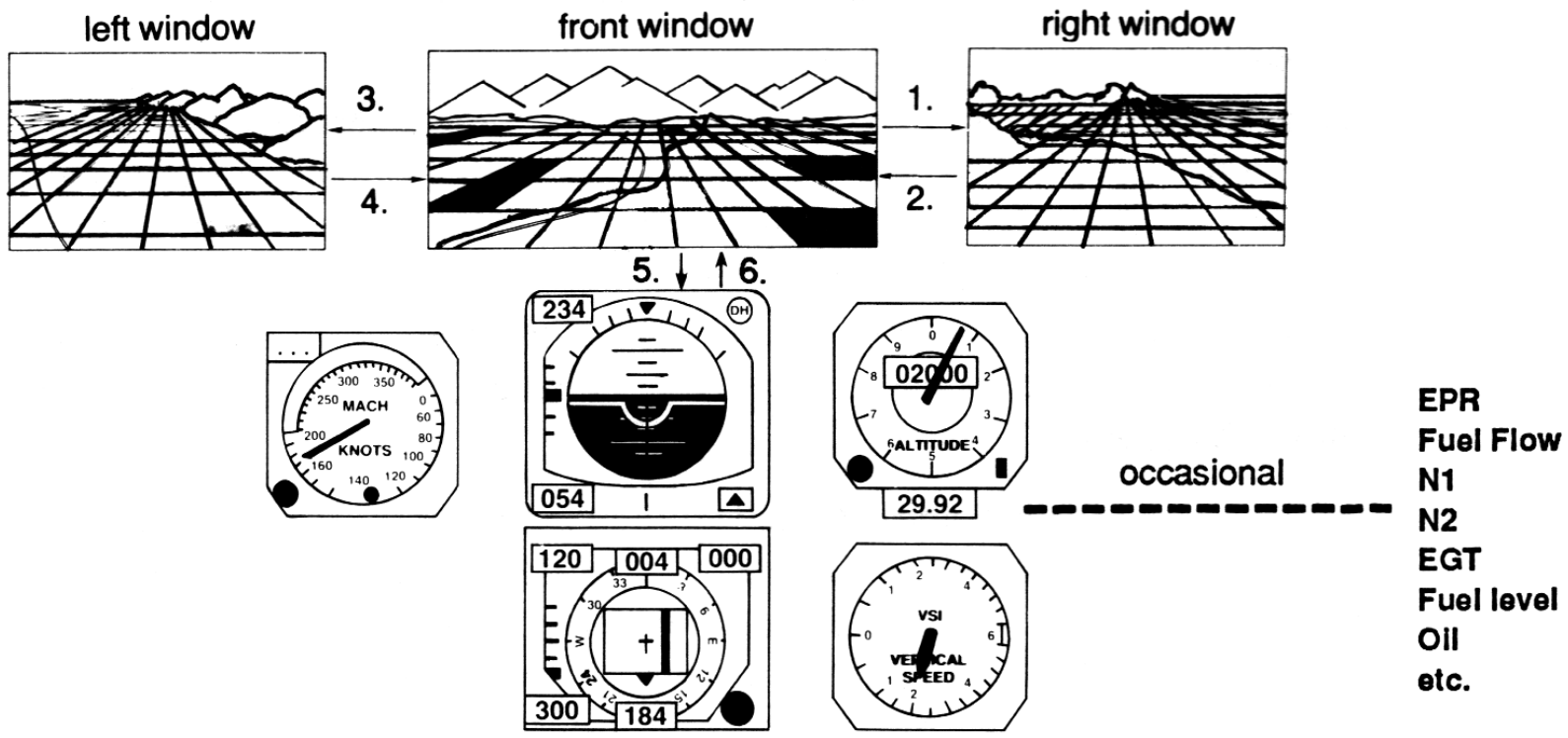
Basic Flight Maneuvers

Information Scan

To effect proper aircraft control through flight instruments and visual cues, you have to develop a good information scan technique. Figure 7.21 illustrates a good sequence to follow. Since thrust remains rather fixed, engine instruments are included only occasionally in the scan. Don't construe "occasionally" to mean secondarily but rather just less often, perhaps once every thirty seconds.



a) instrument flight



b) visual flight

Figure 7.21. Aircraft Control Scan Sequence

Note that in the top diagram (instrument flight) the attitude indicator becomes the central hub of viewing activity. Since you effect aircraft control toward a goal through the attitude indicator, its central nature is obvious.

Time spent looking at any one instrument should be long enough to ensure correct interpretation of the instrument. Don't rush it.

The visual scan (bottom diagram) ensures that you will look for traffic while flying. There are pilots guilty of not looking out the window during visual flight. Apparently they assume that there's plenty of room in three-dimensional space and the probability of collision with another aircraft is small. Over time probability can catch up with you, and mid-air collisions do occur.

You may question your ability to maintain aircraft control while looking outside the aircraft. The wings and nose can provide you with the same information the attitude indicator gives, once you've learned to interpret their orientation. After all, the attitude indicator only simulates actual physical orientation.

Bank Control

During straight flight the obvious goal of banking is to keep a constant heading. Don't fixate on the heading indicator, as such activity can lead to chasing the indicator. Like most aircraft control activity, you should use the attitude indicator or natural horizon as a means to control heading. If you notice that you're off your assigned heading, enter a shallow bank on the attitude indicator or natural horizon. Cross-check heading during the scan and rollout using the attitude indicator or natural horizon.

Turns

While shallow turns may be used for minor heading corrections, most turns that you make will be at a 30° bank. Light aircraft use a shallow bank for a "standard rate" two-minute turn on instruments, but as aircraft speed increases the rate of turn at a given bank angle diminishes. To compensate, many commercial jet aircraft use a slower "four-minute standard rate turn", but most modern jet transports have dropped the formalities (and the primary panel's turn indicator) and leave bank amount up to the pilot's discretion.

The 30° bank turn is entered on the attitude indicator or, if visual, via the natural horizon. Roll the aircraft in the desired direction. As you roll into the turn, notice the degree of bank on the index at the top of the attitude indicator. If you are flying visual, you can press [Alt][A] to turn on a visual attitude indicator (VAI) that superimposes 30° angled orientation lines over the cockpit forward view as a visual alignment aid. You will also have to pitch up slightly to avoid losing altitude in the turn.

During the turn you will need to cross-check altitude and heading. Using pitch to control altitude is discussed in the next section of this chapter. Use the heading indicator to cross-check for your goal heading, and begin your rollout prior to reaching

the desired heading. A good rule of thumb is to begin rollout at the number of degrees equal to half your bank angle. If this rule doesn't work well for you, just increase or reduce your aileron pressure (roll rate) until it does work. Lower pitch back to the required non-banking pitch attitude as the aircraft rolls out.

Pitch Control

The FAA issued a bulletin in the mid-1970s in an attempt to simplify the teaching of pitch control. This bulletin proclaimed that when thrust is fixed, pitch controls airspeed. When thrust is variable, pitch controls altitude or change in altitude.

Thrust is fixed only during climbs and at idle. Thrust is variable during cruise level flight, airspeed transitions and on final approach descents.

There will always be arguments as to whether pitch or thrust controls altitude or airspeed during specific maneuvers. If you observe a professional pilot's technique, you won't be able to tell what inputs are controlling which goals. You will, however, find it necessary to separate the uses of pitch and thrust until your flight control technique becomes automatic.

Approximate pitch/thrust combinations for different segments of flight are listed in the ATP Quick Reference Handbook (QRH). Consult the "Approximate Flight Settings for SubLOGIC Airlines B737-250" section of the handbook to determine possible pitch and thrust settings for the following maneuvers.

Level Flight

During level flight you should use pitch to control altitude and thrust to control airspeed. If you notice that you are low, pitch up slightly. If you are high, then pitch down accordingly.

Control airspeed with thrust. If your airspeed is low then add thrust, and vice versa. Changes in pitch will affect airspeed and changes in thrust will affect altitude, but you must separate the uses of pitch and thrust to obtain control. If you change pitch attitude and hold this attitude constant, you've simplified a set of flight equations. In most cases, after the aircraft stabilizes at a new equilibrium only one rate of climb and airspeed can result.

The concept of holding pitch or thrust constant is very important. Note that to hold pitch constant, you will have to vary pitch pressure (or, in this simulation, elevator position) as the aircraft changes speed. If you're careful to hold a constant pitch, the aircraft will settle to its new equilibrium. Once you've determined the resulting equilibrium, you may need to estimate (and readjust) the pitch as required for any desired change in altitude (zero change for level flight).

Just use your common sense in maintaining a level flight pitch attitude. If one pitch attitude causes a climb and another causes a descent, then the zero-climb pitch attitude must be somewhere in between.

When you're within 200 feet of your assigned altitude, corrective pitch changes will be small and airspeed changes minor enough to be ignored. If you're more than 200 feet off from your assigned altitude (100 feet at slow airspeeds), the required pitch change may be too great. You will then have to use a climb or descent, with thrust change, to correct your altitude.

Climbs

The climb is broken into three separate components; entry, constant climb, and level-off.

Entry: Assuming normal cruise flight, a climb is initiated by pitching the aircraft nose up. After this change in pitch, add climb thrust. Remember, "pitch then thrust". Adding thrust before pitching does little to aid the climb. The only exception to the pitch/thrust rule may be when transitioning to a climb from slow flight.

Constant Climb: At climb thrust, use pitch to control your airspeed. Remember to hold pitch constant and wait for the resulting airspeed, then adjust pitch according to your estimate of the pitch required to obtain the desired airspeed (nose up for less airspeed, nose down for more). You will normally pitch for a 250-knot climb under 10,000 feet (speed limit) and a 300-knot cruise climb above 10,000 feet. When intercepting mach .7, pitch to maintain .7M.

Level-Off: Just before reaching your assigned altitude, nose down gradually to intercept the altitude. The FAA recommends you start level-off at 10% of your vertical speed before the desired altitude. If vertical speed is 500 feet per minute (FPM), for example, you should start your level-off 50 feet before the target altitude is reached. At this time altitude again becomes the goal of pitch control. Thrust will again control airspeed. Hold full thrust until you reach cruise speed and then reduce to cruise thrust.

Cruise Descents

Like a climb, the descent is broken into three components; entry, steady descent, and level-off.

Entry: The pitch/thrust order is opposite of that required for a climb, i.e., "thrust then pitch". Reduce thrust to idle and then adjust pitch to control vertical speed. You will have to pitch down initially to maintain speed, yet once you've pitched down you will have to use some up elevator to keep the nose from dropping too far.

Steady Descent: The change in pitch attitude required for a descent is less than that required for a climb. At mach .76/300 kts (300 kts is the pitch goal below approximately 25,000 feet), you will have a vertical velocity of 1500-2000 FPM.

For a greater descent rate, deploy spoilers to the FLT (flight) position as indicated on the primary instrument panel. Let the nose drop slightly to maintain speed, and add a touch of up elevator to maintain this new, lower pitch attitude.

Level-Off: As you approach your new assigned altitude, increase throttle to cruise thrust and then pitch to hold a constant altitude. The 10% rule (of vertical speed) works well for level-offs from both climbs and descents.

Slow Descents

Slow descents are usually used during landing approaches, a necessary part of any successful flight. Your final approach speed will be approximately 130 kts with flaps 30 and gear down. Many pilots deviate from the pitch/thrust rule during slow descents and use pitch to control airspeed and thrust to control vertical speed (glidepath for landing).

During slow flight, pitching up to increase lift will not increase the climb rate much or decrease the sink rate much, since the aircraft is already at a high angle of attack where drag increases quickly with angle of attack. The increase in drag quickly slows the aircraft, thus reducing lift again. Pitching up to stretch a glide may get the inexperienced pilot into trouble as airspeed drops below a safe level.

Pilots who use pitch for airspeed control during a final approach will teach that if you need to reduce vertical speed (in order to stretch a glide), add thrust while you increase pitch slightly in order to maintain airspeed. If you need to increase vertical speed (reduce glide range), decrease thrust while lowering pitch to maintain airspeed.

We do not believe in teaching this method. Instead, we prefer that you use pitch to maintain glideslope and thrust to maintain airspeed. Again, though, it is usually difficult to determine which method a smooth pilot is using when making a final landing approach.

Airspeed Transitions

You will need to slow down, and possibly speed up, your aircraft when adjusting to traffic flow upon arriving at an airport. 150 kts with 15° of flaps may be considered a slow speed for your aircraft. A maximum speed of 250 kts below 10,000 feet can be considered fast. Heavy jet transports take a long time to slow down or speed up, so you will need to use a thrust setting beyond the normal long-run requirements to increase acceleration/deceleration. In addition, the landing gear may be lowered below the maximum operating speed of 270 kts to aid in deceleration. You may also find it difficult to slow down during a descent. Plan to level off momentarily until the aircraft has slowed, then resume your descent.

During all airspeed transitions, altitude control will be the goal of pitch and airspeed the goal of thrust. Starting at cruise airspeed, decrease thrust to idle. As the aircraft slows, adjust pitch to maintain altitude. Once below the maximum flap extended speed (add 20 kts to the speed listed in the QRH schedule), add 15° of flaps. As the airspeed nears 150 kts add thrust (adjust thrust) to maintain 150 kts.

To accelerate back to cruise airspeed, add climb thrust. Adjust pitch to maintain altitude, and remove flaps as per the QRH flap use schedule. As the aircraft approaches cruise speed, reduce throttle to cruise thrust.

Takeoffs

Note your takeoff time on paper, and then line up with the runway centerline. Smoothly apply full throttle. As the aircraft accelerates to the rotation speed of approximately 140 kts, pitch up 10°. Once the landing gear is retracted and flaps are retracted according to the QRH flap use schedule, hold the pitch attitude until you accelerate to 250 kts.* Reduce throttle to climb thrust (a fixed thrust for the purpose of teaching aircraft control goals), then adjust pitch attitude to maintain 250 kts until you reach an altitude of 10,000 feet. At 10,000 feet, lower the nose to approximately 5° and then adjust pitch to maintain a 300-knot climb. If you are climbing to a high altitude, your 300-knot climb attitude will intercept mach .7, after which you will adjust pitch to climb at .7M until level-off.

* Real procedure in most powerful jet transports involves rotating to a pitch attitude of 15° or more, getting the gear up right away, then waiting until a safe altitude (maybe 1000 feet) before flap retraction. The reduction to climb thrust and acceleration to 250 kts may not occur until 3000 feet. ATP does not require this procedure since you would lose sight of the ground beyond the nose of the aircraft. If you prefer, you may wish to use the standard procedure.

8 Boeing 737 Flight Lessons

Flight Assignment: A.T.P. provides such a sense of realism that one must carefully analyze where this realism transfers to actual flight. The flight lessons in this chapter describe how to perform the maneuvers used to fly a real commercial transport aircraft. These lessons are not organized the way real flight lessons would be. Some basic concepts (e.g., coordination) are not covered at all while other, more advanced concepts (e.g., instrument approaches) are explained in some detail. Concepts that are covered are consistent with the realism and goals of the ATP simulation.

As stated in the previous chapter, these flight lessons are designed to teach you correct methods of flight control. The implications of the early learning of bad flight control habits go beyond just the subsequent difficulty of unlearning those habits. In times of emergency, you tend to revert to your early learning. Acquiring proper pitch control and instrument scan techniques is so important that flight instructors remind their students of the proper control procedures very often during the first flight lessons.

Please remind yourself that when we say "establish a pitch attitude", we mean pitch attitude and not elevator position. You must vary elevator position to keep a constant pitch attitude until the aircraft stabilizes. Once you've internalized where to place your pitch attitude for different airspeeds, throttle settings, flap and spoiler positions, bank angles, and aircraft weights, then you will have mastered aircraft control.

Even if you are an accomplished computer pilot, we recommend that you review the flight maneuvers described in this chapter. Pay special attention to the "New Feature:" announcements that describe how to use some of the new and/or interesting simulation features incorporated into the ATP program. All pilots should read the "Approach, Descent and Landing" section, since the big commercial jets require a stabilized approach for a successful landing.

Aircraft Control

One or more of the following types of useful information are provided for every assigned flight maneuver:

Flight Mode: In most cases, a predefined flight mode is available for you to use to perform the described flight maneuver. All flight modes are listed in the Available Modes column on the [F2] Mode Library menu. Use [F2] Mode Library menu option 2 to select the appropriate flight mode, then use option 8 to load it (see Chapter 11).

Method: The method(s) you should use to perform the assigned flight maneuver.

Mistakes: Common mistakes made by pilots when performing the flight maneuver.

Limits: Use these suggested limits to grade your performance in normal flight mode. In the ATP flight assignment modes (see Chapter 17) these limits are used to evaluate your performance and assign an airmanship score.

New Feature: Describes a new or interesting simulation feature for you to try.

Suggested Assignments: Variations on the assigned flight maneuvers.

Most flight maneuvers are split into visual versus instrument maneuvers. When performing a visual flight maneuver, we recommend that you take your pitch attitude indications from the natural horizon rather than the attitude indicator. A visual attitude indicator (VAI) may be superimposed over the cockpit forward view to help you properly orient and/or align the aircraft when performing visual flight maneuvers. The VAI plots horizontal pitch orientation markers in the center of the cockpit forward view at 0°, 2.5°, 5°, and 10° that correspond with the recommended aircraft pitch attitudes for varying flight regimes. The VAI also plots 30° angled orientation lines on both sides of the cockpit forward view to help you make 30° banked turns to the left or right, and includes a runway target bracket to help you set up a landing approach path to the runway. The VAI is toggled on and off by pressing [Alt][A] from normal flight mode.

Flight modes with a VIS suffix are used to practice visual flight maneuvers, and have the VIA turned on. Flight modes with an INS suffix are used to practice instrument flight maneuvers. They have no VIA, but may have clouds turned on so you can practice instrument flight at L(ow) or H(igh) altitudes.

Stability Demonstration

Lesson 1

Flight Mode: LMLVIS

Select the [F2] Mode Library menu, and select and load the LMLVIS flight mode. When you return to normal flight mode, press [P] to unpause the simulation.

Note your initial airspeed, then increase thrust to climb power (press [I]) and let the aircraft start to climb. The aircraft will pitch up as a result of your increased airspeed, causing increased tail down force. Note that your new equilibrium airspeed is close to your initial airspeed but the aircraft is at a higher pitch attitude.

Reduce to idle thrust (press [0]) and note the long-run equilibrium.

What lesson do you learn from this? When a constant airspeed is your goal on entry, level-off, and during a climb or descent, you initially will have to pitch with elevator to hold airspeed, but you will have to take most of the elevator change out once you're at the new equilibrium pitch attitude.

New Feature: Press [Alt][Ctrl][0] to return to the beginning of the same flight mode.

Level Flight Lessons

Lesson 2

Flight Mode: LMLVIS

Method: Select and load flight mode LMLVIS from the [F2] Mode Library menu, then press [P] to unpause the simulation. Your goal in this lesson is to use pitch control (keypad [8] to pitch down, keypad [2] to pitch up) to hold altitude. Establish small changes in pitch attitude to adjust altitude. The elevator fine pitch control keys (keypad [7] for fine pitch down, keypad [1] for fine pitch up) also may prove useful.

Mistakes: Chasing the altitude goal with elevator inputs rather than making small pitch changes with elevator inputs. This can lead to large oscillations if you start to get behind the natural oscillation trend. Observe oscillations and give small elevator inputs opposing the oscillation pitch direction.

Limits: ±200 feet is OK for an acceptable airmanship score.

New Feature: The LMLVIS flight mode puts you at 7000 feet just northeast of New York City facing southwest towards N.Y.C., Philadelphia, and the Washington/ Baltimore areas. Practice using the keyboard-selectable scenery masks (press [Alt][;] to select cruise scenery, [Alt]['] for maneuver scenery, [Alt][Enter] for final approach scenery), and note how the frame rate speeds up or slows down depending on which scenery mask you select. The maneuver and final approach scenery masks may be used to speed up the frame rate when performing low-altitude maneuvers and on final landing approach respectively.

Lesson 3

Flight Mode: LMLINS

Method: Select and load the flight mode, then press [P] to unpause the simulation. You're in the clouds now, so practice using the ADI's artificial horizon to establish pitch.

Limits: ±300 feet

Lesson 4

Flight Mode: LMHVIS

Method: Same as Lesson 2. Notice differences in aircraft response and the look of ground scenery at FL250 (25,000 feet altitude).

New Feature: Press [Alt][+](keypad) and [Alt][-](keypad) to accelerate and decelerate the passage of time. Flying from New York City to Baltimore at 4X normal speed is fast and fun. The flight equations are also accelerated, and this is a good time to familiarize yourself with pitch control during accelerated flight.

Lesson 5

Flight Mode: LMHINS

Method: Same as Lesson 4, but now you're on instruments again.

Climbs and Descents

Lesson 6

Flight Mode: LMLVIS

Method: Use up elevator (keypad [2] key) to pitch to 9 degrees and apply climb thrust with the [I] key. As the nose reaches 9°, you'll find some down elevator application is needed to hold the pitch attitude. Adjust pitch to maintain 250 kts (the speed limit below 10,000 feet). Level off at 9000 feet by pitching down as you decrease thrust (make rapid double [-] keypresses until you attain 2600 lb/hr FF). Reset FF to maintain 250 kts.

To enter a descent, reduce power to idle thrust (press [0]) and slowly lower the nose to 1.5°. Once at 1.5° the nose will want to keep lowering, so add up elevator (keypad [2] key) gradually to keep the nose at 1.5°. Make further adjustments in pitch attitude to maintain 250 kts. Level-off at 7000 feet by adding thrust and pitching up to a level pitch attitude. Again, use opposite elevator application once you reach your goal to keep from overshooting the desired pitch attitude.

You should find descents easier than climbs, so practice the application of spoilers on some of your practice descents. Wait until you are in a descent, then deploy spoilers to FLT (flight) setting (press the keypad [Ins] key twice). The nose will want to drop. Apply up elevator so as to only let it drop the one degree needed to maintain airspeed. 500 feet before level-off altitude retract the spoilers (press the keypad [Del] key twice) and re-establish the pitch attitude needed for normal descent.

Mistakes: It's perfectly normal to overshoot the level-off altitude when first practicing climbs. Also, you may gain airspeed if you can't reduce thrust quickly enough. The inability of the simulation to share time in keyboard keypresses complicates the situation. SubLOGIC Flight Controls I or other flight controls or joysticks with a throttle may make this maneuver much easier. Keep practicing.

Limits: airspeed during climb, descent, or level-off: 250 kts ±30kts
altitude on level-off: ±200 feet

Lesson 7

Flight Mode: LMLINS

Practice low-altitude climbs and descents on instruments.

Limits: airspeed during climb, descent, or level-off: 250 kts ±30kts
altitude on level-off: ±300 feet

Lesson 8

Flight Mode: LMHVIS, then LMLVIS

Pitch to 5°, apply climb thrust (press [I]), then readjust pitch to climb at mach .7. Level-off at FL290 (flight level altitude 29,000 feet) at a cruise speed of .74M. Since you need to accelerate slightly after level-off, the simulation keypresses should prove easier than the 250-kt climb/250-kt cruise low-altitude scenerio.

Descent entry may also prove easier. Since a .76M/300-kt descent is at a faster speed, you can begin to pitch down before setting idle power. Note the suggested Boeing 737 pitch attitude and comments in the ATP Quick Reference Handbook (QRH). Once in a .76M/300-kt descent, note your high vertical velocity as compared to a low-altitude descent. Level-off at FL250. Practice using spoilers in some descents.

Limits: airspeed: +.02M, -.4M
altitude on level-off: ±200 feet

Suggested Assignments: Use flight mode LMLVIS to begin a climb to FL290. At 10,000 feet pitch for the 300-kt climb, and at 18,000 feet set 29.92" on the altimeter (note the original setting for your descent). Adjust pitch when you intercept mach .7 to maintain a .7M climb. Level off at FL290. Descend to 7000 feet using the .7M/300 kt descent to 10,000 feet, then the 250-kt descent. Reset the altimeter setting when you descend through FL180. Since this exercise is designed mainly to establish airspeed and altimeter setting habits, use accelerated time as desired.

Mistakes: The most common error is forgetting to set the 29.92" standard altimeter setting when climbing through 18,000 feet. If Air Traffic Control notes a contestable altitude discrepancy, this is often the problem. When descending during a flight assignment, Air Traffic Control will give you a local altimeter setting, minimizing any problem in a descent.

Turns

Lesson 9

Flight Mode: LMLVIS

Enter a 360-degree turn to the left (whole turn). Note your entry heading. After pressing the left aileron key (keypad [4]), give some up elevator to keep the nose from dropping. In fact, you will have to raise the nose slightly above the level flight pitch attitude in order to maintain your upward component of lift. When the angled orientation lines on the VAI are parallel to the horizon you have attained the recommended 30° bank angle.

During the turn you will have to find the proper pitch attitude to hold altitude. You will also have to periodically re-apply left aileron for a short duration to re-steepen the bank as the simulation's artificial roll stability tries to roll the aircraft level.

Include the heading indication in your scan when turning, but try not to fixate on the heading indicator. Lead your rollout so as to finish your turn on the desired rollout heading (in this case the same as the entry heading). Reduce pitch during the rollout to a level flight attitude.

Repeat the maneuver to the right.

Mistakes: Inadequate pitch increase during roll in and, conversely, reduction of pitch on rollout usually causes altitude control problems.

Limits: altitude: ±200 feet
roll out heading: ±10 degrees

Lesson 10

Flight Mode: LMLINS

Try it again on instruments. The reference lines at the top of the attitude indicator show bank increments of 10 degrees; the last line on either side indicates a 45° bank angle.

Limits: altitude: ±300 feet
roll out heading: ±10 degrees

Suggested Assignments: Once you can hold altitude in a turn, make turns of only 90-degree duration to both the left and right. You will have more opportunity to master altitude control during the roll in and rollout. Try turns at slower speeds and higher speeds. Notice that the rate of turn decreases at higher airspeeds.

Try visual and instrument turns while in climbs and descents, observing the limits for those maneuvers.

Airspeed Transitions

Lesson 11

Flight Mode: LMLVIS

Note the QRH pitch attitude and fuel flow suggestions for approach speed level 170 kts, flaps 5, and at 150 kts, flaps 15, gear down. You will practice transitions between the 250-kt cruise speed and these approach settings. Note also that you should apply (or when increasing airspeed, retract) flaps 20 kts above these speeds.

Reduce thrust to idle, pitching up gradually to hold altitude as the aircraft slows. At 190 kts apply 5 degrees of flaps. Add power and adjust pitch to find the setting for 170 kts level. Hold this setting for a short duration until you are satisfied that you understand the aircraft's pitch and thrust requirements. Next, set flaps to 15° and add thrust. Finally put the landing gear down and add more thrust, pitching to hold altitude. Avoid getting low and slow with flaps and gear down. Think ahead and increase thrust early. If you end up low and slow, add a lot of thrust to get your altitude and airspeed back to the goal values.

When you are satisfied with your aircraft control at approach speed and configuration, accelerate back to 250 kts cruise speed. Apply extra power, raise the landing gear, retract the flaps according to the schedule +20 kts and adjust pitch to maintain altitude. When approaching 250 kts, reduce power to the 250-kt cruise setting.

Limits: altitude: ±200 feet
airspeed: ±20 kts (at 150 kts or slower; -10 kts)

Mistakes: Poor attitude control during configuration change (apply elevator to adjust pitch as desired). Low and slow with flaps 15 and gear down. On the speed up, gaining altitude as the aircraft continues its acceleration to 250 kts is common until you internalize the fact that every small amount of airspeed increase causes the nose to pitch up. This is due to the downward force on the tail caused by stable balance.

Lesson 12

Flight Mode: LMLINS

Repeat Lesson 11 "on the gauges".

Suggested Assignments: Airspeed transitions in turns. When you can do these well, then you have truly mastered aviation.

Takeoff

Lesson 13

Flight Mode: LMTO

The "Flight Checklist" in the QRH describes Before Takeoff, Takeoff, and Climb tasks. You will find the recommended V speeds for takeoff near the end of the "Approximate Flight Settings for SubLOGIC Airlines B737-250" outline (in the QRH). In free flight mode, look up your aircraft weight by selecting option 4, Aircraft Loading, on the [F6] Aircraft menu. Only one airspeed bug is available on the airspeed indicator, so use it to set V_2 and commit V_R (rotation) speed to memory.

Perform the Before Takeoff tasks on the checklist, then takeoff and climb as described in the next sections of the checklist. In realistic flight mode (selected by setting the [F6] Aircraft menu option 3, Aircraft Control, to Real), the most difficult parts of the takeoff are compensating for pitching moments due to flap and gear retraction, reducing power to climb thrust, and compensating for increasing elevator effectiveness as airspeed increases.

The best way to get a feel for these pitching moments is to practice a lot of takeoffs. Being able to anticipate the moments and being in command of pitch control are essential to performing smooth and safe takeoff and departure maneuvers. You'll know you're ready to move on when you are able to keep a 10° pitch attitude (within 2 degrees) during climbout through power reduction.

The configuration warning light (Figure 3.1, item 18) on the primary instrument panel is activated (and emits a low-pitched tone at five-second intervals) whenever the ATP simulation determines that your landing gear, flaps and/or spoilers are incorrrectly positioned for the current flight requirements. During a takeoff, this light will be activated if your flap setting exceeds the maximum recommended takeoff setting when climb (or greater) thrust is applied. The configuration warning light will also be activated if your gear or flaps are extended at too high an airspeed. Pay attention to this warning light, and make the appropriate corrections as necessary.

Limits: airspeed: rotation and initial climb; +20 kts, -10 kts.
pitch attitude (10° until 250 kts): ±2 degrees (those who use the realistic 15° will not be derated)
gear up: within the first 500 feet
flap retraction (schedule plus 20 kts): +20 kts, -10 kts
airspeed (after acceleration to 250 kts): ±30 kts

New Feature: Once you've established a 250-kt climb, take a look back at the runway (press [Shift][2]) and then look off to the left side of the aircraft (press [Shift][4]) to see your dramatic climb angle. Press [Shift][8] to return to forward view when you're done looking around.

Approach, Descent and Landing

Lesson 14

Flight Mode: LMSFOFIN (LMSANFIN on slower machines)

This flight mode puts you on final approach for runway 28R at San Francisco International. (The alternate flight mode for slower machines is a final approach to runway 9 at the simpler San Diego airport). You are in the 170 kt, flaps 5, gear up, level configuration which you practiced slowing to while performing airspeed transitions in Lesson 11. The aircraft is aligned to hit the runway if you don't give any roll inputs. This way you can practice pitch/thrust control only. If you accidently press a roll control key you may want to reset the mode (press [Alt][Ctrl][0] to reset). At the end of this maneuver lesson you will use roll control.

After unpausing the simulation, put the gear down, set flaps 15 and add thrust to 3600 lb/hr FF to hold level. Set the spoilers to ARM (press [Ins] one time) before you begin the approach. They will deploy automatically upon touchdown when you apply reverse thrust. If you forget to arm the spoilers you can expect a much longer ground roll.

As an aid to help you determine a suitable glidepath, the runway ILS (Instrument Landing System) is already tuned in. Radio navigation is explained later in this chapter; for now, just note the glideslope deviation index needle just above center on the left side of the ADI. As you near the airport in level flight it will come down to center, after which you must apply flaps 30 and reduce thrust to 2500 lbs/hr FF as listed for final approach descent in the QRH. This setting will start you down the glidepath at about 140 kts.

If you were in instrument flight, after intercepting the glidepath you would pitch toward the glideslope needle (pitch up if the needle is up). As a visual cue, the runway target bracket in the VAI shows the correct landing approach pitch attitude. As you get close to the runway, aim at the runway threshold (beginning).

As you pitch for glidepath control, adjust thrust to keep the airspeed at 140 kts. Limits are ±10 kts on final approach airspeed. If you are too fast on final approach you may overshoot the runway, especially if (after landing) you are slow to reverse thrust and apply brakes or if you forget to arm the spoilers. If you are too slow, you may find that the aircraft has little "flare" (level-off) capability upon reaching the runway. You can also get into a situation where high form drag sets in, making you drop short of the runway. Apply three rapid keypresses of thrust ([=] key) if you slow to under 120 kts. Once your airspeed rises, reduce power again.

As you approach the runway threshold you must flare the aircraft just before touch-down. Reduce thrust to idle and pitch up slowly about 3 more degrees. You should end up with a 6° to 7° pitch attitude upon touchdown. Force the nose down to level, make

sure that you have idle thrust, then hold down the thrust reverse key (keyboard [9] key) until the throttle indicator shows full reverse thrust (all the way down). Thrust reversers will not deploy unless you first reduce to idle. Press and hold the brake key (press [M]), releasing only as necessary to apply ground steering. Once stopped, zero the throttle to prevent the aircraft from backing up due to reverse thrust application.

Now try it again. Press [Alt][Ctrl][0] to reset the flight mode, unpause, fly level, set spoilers to arm, intercept the glidepath, apply flaps 30 and reduce power to 2500 lbs/hr FF. Pitch for the glidepath, and use thrust to adjust your airspeed. Happy landings!

Once you have a good feel for pitch control, reset the approach flight mode and press [Alt][S] to enter slew mode. Unpause the simulation, press the keypad [4] or [6] key several times until you're slightly left or right of the runway centerline, then press the keypad [5] key to stop moving. Press [P] to pause, and press [Alt][S] to exit slew mode. Unpause the simulation and try it again. This time you have to get on the runway centerline as well as practice glidepath control. It may take awhile to sense when you're on centerline and tracking straight. You'll also find that large last-minute corrections can be disastrous. Practice getting set up early in your approach.

During a final approach and landing, the configuration warning light (Figure 3.1, item 18) will be activated if your airspeed drops too low and the landing gear is not extended. The configuration warning light is also activated when spoilers are extended at thrust settings greater than 20%. Check the aircraft control position indicators and take the appropriate corrective measures when you see (and hear) this warning.

Limits: configuration: gear down, spoilers arm, flaps as desired
airspeed: ±10 kts
landing location: try to get close

New Feature: Press [Alt][Enter] to turn on the final approach scenery mask which eliminates all scenery except the runway environment. Check the landing approach frame rate versus scenery complexity and closeup runway marking complexity using this scenery mask and the other available masks ([Alt][;] for cruise scenery, [Alt]['] for maneuver scenery).

Important Assignment: Once near the threshold, go-around as described on the QRH Go-Around checklist. This will be a required maneuver in the assignment modes.

Suggested Assignment: When you think you're getting good at landing the aircraft, load the CGX36FIN flight mode (Meigs Field, Chicago) from the [F2] Mode Library menu. You will have 4000 feet of runway on which to land. Do not use a shallow approach. Instead, aim the VAI runway target bracket just before the runway, change your aircraft weight to 85,000 pounds total (select option 4, Aircraft Loading, on the [F6] Aircraft menu), and use 130-kt final approach speed. If you are able to stop on the runway, congratulations! (We wonder if a real Boeing 737 will ever land at Meigs!)

Navigation

Background

An essential component of navigation is the concept of direction (see Figure 8.1).

The compass rose in Figure 8.1 shows how direction is described using a 360° circle system where 0 or 360 degrees indicates north, 90 degrees is east, 180 degrees is south, and 270 degrees is west. The following terms are defined in the compass rose system:

Heading	-	The direction you point the nose of the aircraft.
Course	-	The direction over the ground which you would like to fly.
Track	-	The actual path over the ground which you take.
Wind Correction Angle	-	The angle used to compensate for wind drift.
Radial	-	The direction from a navigation aid.
Bearing	-	The direction to a navigation aid.

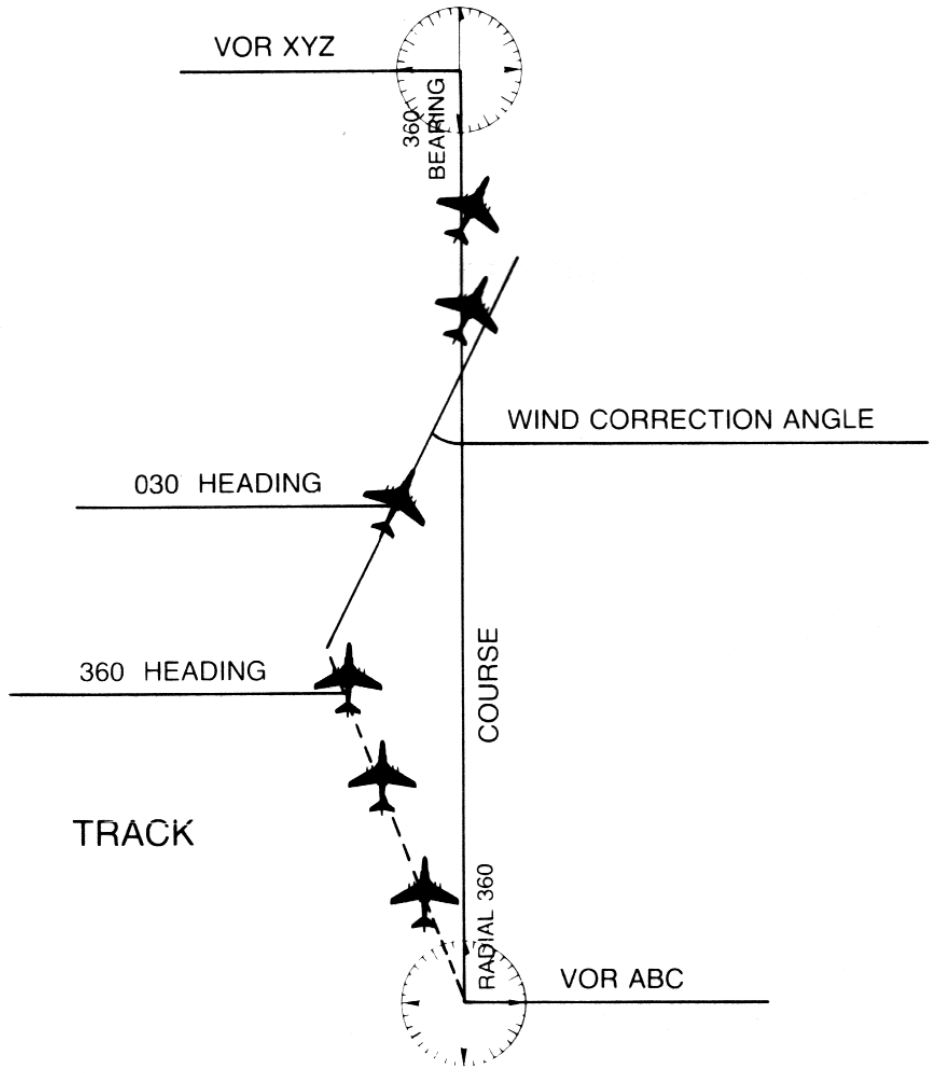


Figure 8.1. Compass Rose Navigation Terms

Direction may be oriented towards magnetic north or true north. Winds aloft forecasts are routinely provided with reference to true north. Most other weather, routes, and physical structures are defined in terms of magnetic north. Such items include surface wind reports, runway designators (runway 9 heads approximately 090 degrees magnetic), enroute and approach courses.

Historically, the following methods of navigation have been used:

Celestial	-	Using the sun, stars and moon.
Pilotage	-	Using maps noting positions of prominent landmarks.
Dead Reckoning	-	Estimating heading and time to a goal location using forecast or known winds.
Radio Navigation	-	Using airborne electrical equipment to receive and process signals from ground-based equipment providing location and other navigation information to the pilot.

Within the past twenty years radar coverage has increased to the point where the majority of airline flights into major cities are trackable, allowing the availability of:

Radar Vectors	-	Headings given by ground-based personnel.

While we strongly encourage the development of pilotage and dead reckoning skills, ATP will directly guide you using radar vectors and will require you to develop radio-navigation skills if you wish to advance in the flight assignment modes of this simulation.

The primary navigation radios available in ATP are the VOR/ILS receivers and indicators, ADF receiver, RMI, DME receiver and indicator, and IRS. Since Jet Routes (defined by VOR and DME nav-aids) and ILS approaches provide the primary radio navigation structure for ATP, this chapter covers just the equipment necessary for this course guidance. Use of the IRS (inertial reference system) is covered in Chapter 15.

Enroute Navigation

Lesson 15

Flight Mode: LMLVIS

It's time to learn how to use the Navigation keyboard controls. Navigation-related keyboard controls have been grouped separately from other control functions (flight control, communications, etc.), in that all navigation functions must be performed while holding down the [Shift] key. Since Flight Assignment: A.T.P. has many more radios than previous SubLOGIC simulations, you must first reference (select) a radio, and then use other [Shift]-based controls to set or adjust the selected radio as desired.

After selecting and loading the LMLVIS flight mode, look for the small diamond highlight symbol (a + symbol on low-res screen displays) in the NAV1 radio frequency selection area. This highlighter symbol indicates that the NAV1 radio is currently selected. If you can't find the highlighter symbol, press [Shift][2] to select NAV2 and you should see the diamond move over to the NAV2 frequency selection area.

VOR (Very high frequency Omnidirectional Range) radio stations transmit a signal that can be decoded by the NAV receivers in your aircraft, allowing you to determine what radial you are on relative to the transmitter station or to determine the bearing to the station regardless of your aircraft's orientation. You may also set a specific course TO or FROM a station.

NAV1 and NAV2 receivers may be tuned to VOR frequencies. In the currently loaded flight mode, NAV2 is tuned to La Guardia (LGA) VOR at frequency 113.10. Refer to the Northeast U.S. area map included with the ATP program, and locate the compass rose for LGA VOR on the chart (near New York City) to get an idea of your approximate location.

Press [Shift][1] to select NAV1, and make sure that the diamond highlight symbol is now on NAV1. Press [Shift][=] and [Shift][-] several times each, and note that these keypresses increase and decrease the full megahertz frequency value tuned on the NAV1 radio. Press [Shift][right bracket] or [Shift][left bracket] to increase or decrease the fractional frequency value in 50 kHz increments (.05, .10, .15, etc). Use these controls to tune in JFK VOR at frequency 115.90, then locate JFK VOR on the Northeast U.S. map. Press [Shift][I] to hear the identification code for the VOR transmitter tuned on the selected NAV radio. The identification code is repeated every 15 seconds. Press [Shift][O] to turn off the ident code. A running ident code will continue until completed.

Next, press [Shift][9] and [Shift][0] to adjust the omni-bearing selection (OBS) heading. Note that the course selection changes in the OBS boxes in the top and bottom left corners of the attitude director indicator (ADI) for NAV1, and in the OBS boxes on the the horizontal situation indicator (HSI) for NAV2. The top box shows your selected course, while the bottom box provides a useful reference for the reciprocal (opposite) heading. Hold down one of the course selector keys and, as the course selection changes, note the TO, OFF, and FROM flag operations as well as the course deviation index (CDI) needle movement at the bottom of the ADI. A single flag in the lower right corner of the ADI indicates TO, OFF, or FROM. On the HSI, an upward-pointing arrow above the CDI box denotes TO, a downward-pointing arrow below the CDI box denotes FROM, and a flag in the CDI box denotes OFF.

Use the [Shift][9] and [Shift][0] course selector keys to find a selection that centers the CDI needle on the ADI with the FROM flag showing. You may overshoot the course selection since the needle has dampening. If so, slowly tap the opposite course selector

keys until the needle centers again. The selected course that centers the needle with the FROM flag showing indicates what radial of JFK VOR you are on.

If you wanted to fly to the station you would center the needle with the TO flag showing. The course selection would be the reciprocal heading shown in the lower left box on the ADI. Use either course selector key to center the needle with a TO flag showing. (Note that as your course selection passes 90 degrees to a centering selection the OFF flag appears but the needle remains "pegged".) The needle recentering on the 198° selection tells you that to fly to JFK VOR you would have to take up a heading of 198 degrees ±wind correction angle.

While you can use the information obtained by centering the needle with a TO or FROM flag showing, you often will have to fly a predetermined route. Press [Shift][2] to select NAV2. It's set to J42 (Jet Route #42) because the LGA VOR frequency is tuned in and the 235° course selected matches that of J42. The Northeast U.S. map shows the reciprocal of this selection but, if you want to fly a portion of the airway toward a VOR, you must use a selection which approximately matches the TO heading. Note that the CDI needle on the HSI is slightly to the left of center.

It is often simply stated that to get on course you must fly to the left until the needle centers. Rather than just making a left turn, however, you must choose a heading to the left of a heading which just parallels J42. Press [Alt][S] to enter slew mode. Press the keypad [1] key several times to change your heading, let the aircraft go around one full circle, and press [5] to stop changing heading when you return to 235. Note that the CDI needle doesn't center. Press [Alt][S] again to exit slew mode. To get the needle to center (to get the aircraft on J42), you must decide on an intercept heading to fly rather than just turn the aircraft to the left. Always note the heading of the route and decide on an intercept angle to that heading. If you know that you are reasonably close to an airway then a 30° intercept angle will usually work. Use the course selector to center the needle. It should center with a 215 indication, showing that you are 20 degrees off course. A 30° intercept would work in this case, but you'd intercept awfully close to the station. We suggest a more drastic 50° intercept.

Set the course selection back to 235, unpause the simulation, and fly a heading of 185 degrees to intercept J42. As the CDI needle comes in to center, turn back to a heading of 235 degrees. You're now on the airway flying toward La Guardia. Keep the needle centered to track the airway. Full CDI needle deflection when tracking a VOR is 10 degrees. Therefore, if the needle is not pegged toward one side, you can use a 20°or less intercept to capture the needle.

Bracketing is a technique by which you fly various headings to hold a course, quickly readjusting your heading to find the one that holds your course. Once on course, start by flying a heading that you think will adjust for wind drift. If you drift off course, get back on course and try a heading which you think will overcompensate for the previous

drift. If it does overcompensate, then try a heading in between the last two. Continue cutting the difference between an under- versus overcompensating heading until you find one that holds course reasonably well. This technique will keep you from doing the infamous "S turns across an airway". Wandering back and forth just two or three degrees is acceptable. VOR variability does not allow flight much more steady than two- or three-degree heading change cycles.

Press [Alt][Ctrl][0] to reset the flight mode, then select the [F3] Environment menu. Select option 6, Winds, and set level one winds tops to 40,000 feet, bottoms to 0, dir to 270 degrees and speed to 40 kts. Press the [space bar] to return to flight mode. Intercept your course and fly it using a 235° heading. Notice the needle drift to the right. Take a 20° right intercept (255 degrees) and recenter the needle. Now use a heading in between 235 and 255. You'll find that 245 degrees does a reasonable job of holding course.

In order to fly long distances you'll have to pass a VOR station and track from it, then switch to a new VOR station and track to it (usually when you are halfway to the new station). After you pass LGA VOR, continue on J42 to RBV VOR. Note on the Northeast U.S. map that the 231° radial from LGA VOR defines J42, then the 049° radial (229 degrees TO) of RBV VOR defines the airway. Note also that the two VOR transmitter stations are 45 miles apart. Unless told otherwise, you should switch to RBV VOR approximately 22 miles southwest of LGA. Station passage and station switching will now be discussed.

When you are within two or three miles of a VOR, the sensitivity of the indication is such that chasing the CDI needle would be fruitless. Don't take this to mean that when close to a VOR you can stop trying to track an airway. Instead, make small changes which you believe will keep you very close and hold these headings. Once over the station, the needle must peg one way or another. During station passage note that the OFF flag and the FROM flag operate automatically.

When you see the FROM flag, set the new course with the course selector and then take an intercept. Unless you know that your intercept takes you into a very strong wind, 20 to 30 degrees of intercept will work well for fast aircraft. Since you are close to the station, the needle may come to center very fast when reintercepting course. The faster it moves, the more you will have to lead with the heading change you believe will hold course. Bracket the heading to hold a new course.

Look at your DME indicator. It is already channeled to LGA VOR (or whichever VOR the NAV2 receiver is tuned to). The DME receiver shows distance in nautical miles from the VOR to which you are tuned. The DME is selected by pressing [Shift][3]. Once selected, use [Shift][=] and [Shift][-] to cycle between the VOR stations tuned on NAV1 or NAV2, or to hold the DME1 or DME2 distance displays when retuning a NAV radio. Use [Shift][I] and [Shift][O] to identify the station and then turn off the ident code. Note that the DME identification code is broadcast once every 30 seconds,

whereas a VOR ident code comes on every 15 seconds. One other important factor to note regarding DME use is that it indicates "slant range" distance to the station. If you are one nautical mile above the station, the DME will read 1.0 during station passage.

When your DME reads 22 NM, make sure that you have NAV2 selected and then adjust NAV2 to the RBV VOR frequency of 113.80. Set 229 degrees on the course selecter. If the needle doesn't center as expected, welcome to the real world. Inaccuracies in the system as well as in your your equipment are magnified during station transitions. Press [Shift][I] to hear the VOR's ident code, then press [Shift][O] to turn the ident code off. Track to RBV VOR. When everything is going well, flight legs are a great place to practice using the time acceleration feature. Reset time back to 1X when passing stations, switching stations, making large turns, or anytime the task is not simple.

Now it's time for a brief introduction to the RMI and ADF nav-radios. The radio magnetic indicator (RMI) in the lower left corner of the primary instrument panel allows you to note the bearing to a VOR station and a nondirectional radio beacon (NDB) station or to two different VOR stations relative to your heading. A real RMI has a built-in heading indicator. To fly exact routes you must add the relative bearing (relative to the nose of your aircraft) shown on the RMI to your magnetic heading.

The ADF receiver is tuned to Grimm NDB, a station southeast of JFK airport on a runway 31 approach. The RMI1 reference selecter is set to the ADF position, and the RMI1 needle (the thin white needle) points to the relative location of Grimm NDB. The RMI2 reference selecter is set to the VOR position, and the RMI2 needle (the wide yellow needle) points to the location of the VOR station tuned on the NAV2 radio.

Press [Shift][6] or [Shift][7] to select the RMI1 or RMI2 needle reference selectors. Use [Shift][=] or [Shift][-] to switch between VOR1 (tuned on the NAV1 radio) and the ADF for the RMI1 needle, or VOR2 (tuned on NAV2) and ADF for the RMI2 needle. Press [Shift][4] to select the ADF when you need to tune to a new NDB, and use [Shift][=] or [Shift][-] to increase or decrease the most-significant-digits frequency value, [Shift][right bracket] or [Shift][left bracket] to increase or decrease the least-significant-digits frequency value. Re-fly the last route and note the RMI needles. You'll find that the bearing information this instrument provides can be quite helpful.

The ILS Approach

Lesson 16

Flight Mode: LMSANFIN

An airport runway's Instrument Landing System (ILS) is composed of different navigation facilities that provide highly accurate horizontal and vertical guidance to the decision height (DH) altitude or runway threshold. The ILS also provides accurate

distance information. Turn to the approach chart for San Diego's ILS RWY 9 approach in Appendix IV of this manual, then select and load the LMSANFIN flight mode from the [F2] Mode Library menu.

Find the frequency and identification box for the ILS RWY 9 localizer, I-SAN, on the approach chart. This localizer can be tuned in on your NAV1 radio just like a VOR station. The localizer's guidance is similar to a VOR except that it's fixed to one route (aligned with the runway), so you do not have to adjust the course selector. (Many pilots set the course selecter to the final approach heading, in this case 092 degrees, as a helpful reference.) The sensitivity of the localizer is 4 to 5 degrees peg to peg (compared to a normal VOR sensitivity of 20 degrees), so you can track a very precise horizontal course using the CDI needle below the artificial horizon on the attitude director indicator (ADI). Set the NAV1 radio to 110.90 (if necessary) to tune in the I-SAN localizer, then press [Shift][I] to turn on the ident code to confirm that you've tuned the correct frequency and that the station is transmitting correctly. Press [Shift][O] to turn off the ident code.

The glideslope receiver, while not really on the same frequency as I-SAN, is channeled off it. The glideslope deviation index needle on the left side of the ADI is used to track the vertical glidepath. The glideslope instrument is very sensitive, and allows only 1.4 degrees of glideslope variation peg to peg.

Marker beacons provide distance information. These beacons activate the OMI (outer, middle, and inner) instrument panel lights in sequence as you fly directly over each beacon, and each emits a specific tone sequence to provide audible distance-information feedback. The outer marker is identified by a blue (purple) light and an audible dash-dash code. It is located 4-7 miles from the airport and indicates a position at which an aircraft, at the appropriate altitude on the localizer course, will intercept the glidepath. The middle marker is identified by an amber light and an audible dot-dash stream. It is located approximately 3500 feet from the landing threshold on the centerline of the localizer front course. Approaches used in very poor weather conditions may have an inner marker just short of the runway identified by a white light and a fast-paced audible dot-dot stream. The inner marker indicates the point at which an aircraft is at the decision height on the glidepath during a CATEGORY II ILS approach. The ILS RWY 9 approach is unique in that it only has a middle marker (an outer marker would be located in the water). Load the LMSFOFIN flight mode which puts you on the ILS RWY 28R approach at San Francisco to see and hear these other marker indications.

An NDB station, BOING, is co-located with the middle marker beacon. This can be useful for navigating directly to the marker or can provide a backup for marker location. Note also that DME locations are provided for points along the approach. DME capability is not always provided for the localizer portion of an ILS approach.

Press [P] to unpause the simulation, put the gear down, set flaps 15 and add thrust to 3600 lb/hr FF to hold level. Set the spoilers to ARM (press the keypad [Ins] key one time). Note the slowly falling glideslope deviation index needle above center on the left side of the ADI. As the needle comes down to center, apply flaps 30 and reduce thrust to 2500 lbs/hr FF. Adjust pitch for glidepath control, and adjust thrust to keep airspeed at 140 kts. Since there is no wind, it should be easy to hold a 092° inbound course by flying the 092° heading. Should the localizer (CDI) needle drift left or right of center, make small heading changes (5 degrees or less) to recapture the localizer. When the localizer needle is centered, return to a 092° heading and continue the landing approach. Use pitch to "fly" (follow) the glideslope deviation index needle, and monitor your airspeed as necessary. Confirm that your gear is down and spoilers are armed.

Begin your flare (transition from glidepath angle to landing pitch attitude) 40-60 feet above the runway touchdown point. Reduce thrust to idle and smoothly add up elevator so that you end up with a 6° or 7° pitch attitude upon touchdown. Force the nose down to level when the radio altimeter shows zero feet (indicating that your main wheels have made runway contact), then apply full reverse thrust. Press and hold the brake key (press [M]), releasing only as necessary to apply ground steering. Once stopped, zero the throttle to prevent the aircraft from backing up due to reverse thrust application.

Beneath the profile (side) view on the San Diego ILS RWY 9 approach chart is the minimums section for a straight-in ILS landing approach. The DH350' label refers to the decision height (DH) for the approach in AGL. If you reach this altitude and do not have the runway environment in sight then you must execute a missed approach. The missed approach involves a go-around procedure as listed in the QRH "Flight Checklist". If you are flying a single or career flight assignment, you should begin to follow the missed approach instructions listed on the approach chart and then report a missed approach to Air Traffic Control (see following section).

Communications and Air Traffic Control

The Air Traffic Control (ATC) model in ATP is an active, real-time communications mechanism. A commercial transport pilot must know correct communications and ATC operations procedures for an orderly participation in the airspace guidance system. Your participation in the system begins when you select a single or career flight assignment. This informs the simulation of your flight intentions, and you may then begin communications.

As you fly, you will communicate with ATC using the [Ctrl]-based communications functions. A blue text line at the top of the screen will acknowledge that your [Ctrl]-based communication keypress was received, and will repeat your request/response. ATC will give instructions or respond to your requests using a grey command line at the top of the screen. Some of these messages will require a response, and will be repeated until you "Roger" them with a [Ctrl][Enter] keypress. If you miss or don't understand an instruction or clearance, press [Ctrl][Caps Lock] to recall the last ATC message. Similarly, pressing [Ctrl][X] to request/verify clearance can be used at any time during your flight to recall the clearance message. A complete list of the messages/requests/responses you can use to communicate with ATC is provided at the end of this chapter.

Fly the following sample flight assignment to get a general idea of what you might expect in the way of interactive communications with ATC during a single or career flight assignment. Any procedural variations in an actual flight assignment should be self-evident.

Sample Single Flight Assignment

The following steps will guide you through the ATC communications procedures used in a typical flight assignment. You should be familiar with your aircraft's controls and flight characteristics before you attempt the following flight:

1. Press [F1] to turn on the Flight Modes menu, then select option 3, Single Assignment. On the departure selection sub-menu choose option 1, Select Career Assignment: 000. Type [1] to choose career assignment #1, and press [Enter] to load that assignment. Press [Esc] to continue.

2. Career Assignment #1 is a short flight from Los Angeles Intl (LAX) to San Diego Intl-Lindburgh Field (SAN). Familiarize yourself with the locations of these airports on the large Southwest U.S. area map provided with ATP. Locate the Los Angeles and San Diego approach charts in Appendix IV of this manual, and place bookmarks at the appropriate pages so that you will be able to refer to the charts as necessary throughout the course of your flight.

3. You will be presented with the weather briefing sub-menu. Copy down the weather report information, especially noting wind speed and direction, then press [Esc] to move on to the payload/fuel loading sub-menu.

4. Load fuel to maximum capacity until you are experienced enough to accurately judge how much fuel you will need for a particular flight. In a real flight assignment, you will receive the best grade when you are able to land at the destination airport with no more or less than one hour's worth of fuel remaining in your tanks. Press [1] to set fuel quantity, then type 30000 and press [Enter] to load 30,000 pounds of fuel. Press [Esc] to continue.

5. Your aircraft is positioned near the terminal building at LAX airport in Los Angeles. Look up the **ATIS** (Automatic Terminal Information Service) frequency on any LAX approach chart. Always use the first frequency listed on an approach chart at the appropriate airport for the controller (ATIS, ground, or tower) you wish to contact. (You can check in with generic flight service on frequency 122.20 at any time if you're unable to determine which frequency to use.) In this case use the ATIS arrival frequency of 133.80. Tune this frequency on your COM1 radio to receive a communication from ATIS. The ATIS message will automatically repeat itself as long as you are tuned to this frequency. Write down all ATIS information, including weather and the correct altimeter setting. De-tune ATIS frequency when you've copied down the necessary information or it will continue to repeat itself indefinitely.

6. The frequency for **clearance delivery** is listed on the LAX airport taxi chart. Note that clearance delivery frequency at LAX is 121.40. Set your COM1 radio to this frequency, then press [Ctrl][X] to request clearance from clearance delivery. Copy down all listed clearance information including your "squawk" code. Press [Ctrl][Enter] to "Roger" (readback) receipt of the clearance delivery message.

7. Check in with **ground control** by setting COM1 frequency to 121.65 (the first ground control frequency listed on an LAX approach chart) and pressing [Ctrl][tab]. (The [Ctrl][tab] keypress combination is used to check in with all newly-tuned ATC controllers except clearance delivery.) You will receive taxi instructions. Press [Ctrl][Enter] to Roger (readback) the message.

8. Taxi to your assigned takeoff runway, or simply press the [~] key to select the auto-taxi option and automatically place your aircraft at the assigned takeoff runway. Normally you would have to hold short of the runway, but we've simplified the ATP simulation in this case. (As you progress through the assignments, do not accept a runway assignment from ground control which would force you to take off with a tailwind greater than 15 knots. You may be derated or even crash the aircraft if you attempt to take off with a strong tailwind. Use [Ctrl][/] to

request a different takeoff runway from ground control. You will have to manually taxi your aircraft to the alternate takeoff runway you've requested under these circumstances, since the [~] key can be used only to auto-taxi to the preferred runway initially assigned by ground control.)

9. Perform the Before Takeoff tasks listed in the "Flight Checklist" section of the QRH. Since you are already close to San Diego, set the MZB VOR frequency of 117.80 (see the Southwest U.S. area map) on your NAV2 radio. In the ATP simulation you may receive far-away stations while sitting on the ground that, in actuality, would not be received until you were airborne. Once you are off the ground, your DME indicator will show you the distance to the MZB VOR station located near San Diego Intl-Lindbergh Field. Set NAV1 to San Diego's ILS RWY 9 frequency of 110.90 (see San Diego ILS RWY 9 approach chart). Perform the other items listed on the Before Takeoff checklist. The "squawk" listed in your clearance message is the code which should be set on your transponder.

10. Check in with **tower** at frequency 133.90 (press [Ctrl][tab] when you've set the correct frequency on COM1). Roger his "position hold" instruction, noting the initial heading he wants you to fly. Do not take off yet.

11. Roger the "cleared for takeoff" message from tower, then go ahead and take off. Follow the QRH Takeoff and Climb checklist procedures for gear and flap retraction, reduce to climb thrust at 240 kts, and continue to climb at 250 kts to your initial assigned altitude. Roger all messages as they appear, and be prepared to contact **departure** (set COM1 to frequency 124.50 and press [Ctrl][tab]) when tower instructs you to do so.

12. Pay close attention to all departure messages, and follow departure instructions regarding heading changes, new **center** contacts, etc. (don't forget to Roger each message after you've read it). Level off at the assigned altitude, and reduce thrust according to the "Approximate Flight Settings for SubLOGIC Airlines B737-250" listing in the QRH for medium power level cruise flight. Remember that you must keep your airspeed at 250 kts below 10,000 feet.

13. The DME indicator shows your distance from the MZB VOR located near San Diego Intl-Lindbergh Field. When you are approximately 70 miles from Lindbergh Field, tune-in San Diego ATIS by setting your COM2 radio to frequency 134.80 as listed on the San Diego approach chart. (It's best to use the COM2 radio in this case to contact San Diego ATIS so that you can continue to receive instructions from center on COM1.) Again, the ATIS message will automatically repeat itself as long as you are tuned to this frequency, so write down all ATIS information and then de-tune the ATIS frequency on your COM2 radio.

14. Continue to follow control's instructions as they are displayed. You will be instructed to descend to a lower altitude and reduce your airspeed as you near San Diego Intl-Lindbergh Field. Perform the QRH Descent and Before Approach checklist tasks as required. Make sure NAV1 is selected (press [Shift][1]) and tuned to San Diego's ILS RWY 9 approach frequency of 110.90. Press [Shift][I] to turn on the ident code confirming that you've correctly tuned the ILS frequency, then press [Shift][O] to turn off the ident code. When you receive the message that you are "cleared to land runway 9", it is up to you to intercept the ILS glideslope, make your approach, and land on runway 9. Good luck!

This sample flight assignment provides a brief introduction to the procedures used to communicate with ATC in all single and career flight assignments. The sequence in which you must tune your COM radios to communicate with the various ATC controllers will be the same for every flight assignment (e.g., ATIS, then clearance delivery, ground control, tower, etc.). The full range of possible ATC requests/responses you can make are listed below. ATC communications and flight assignment procedures are described in more detail in Chapter 17 of this manual.

Communication Controls Summary

The following [Ctrl]-based keystroke combinations are used to communicate with Air Traffic Control in single and career flight assignment modes. Note that all communications must be performed while holding down the [Ctrl] key:

Communication	Keys
Roger (readback transmission)	[Ctrl][Enter]
request repeat last transmission	[Ctrl][Caps Lock]
request/verify clearance	[Ctrl][X]
check in with new ATC facility	[Ctrl][tab]
request taxi for takeoff	[Ctrl][.]
request different runway	[Ctrl][/]
request new altitude	[Ctrl][A]
report leaving altitude	[Ctrl][Q]
request frequency change	[Ctrl][F]
request radar vectors	[Ctrl][V]
report traffic/runway in sight	[Ctrl][T]
report missed approach	[Ctrl][M]
request taxi to ramp	[Ctrl][,]
cancel clearance (exit flight assignment mode)	[Ctrl][C]

9 Simulation Controls

A variety of ATP simulation control options may be selected or adjusted directly from normal flight mode. These options include sound, demo recording, slew mode, time acceleration, a visual attitude indicator, and a number of scenery display options. All keyboard simulation control functions must be performed while holding down the [Alt] key.

Sound

All simulation sounds (engine noise, warning sounds) are turned on when you load and run the ATP program. You can turn all sounds off, or turn on warning sounds only. Use the following keystroke combinations to select the sounds you want to hear while in normal flight mode:

Function	Keys
quiet (sound off)	[Alt][Q]
warning sounds only	[Alt][W]
all sounds on	[Alt][E]

Demo Recording

Flight Assignment: A.T.P. includes a demo recording system which you can use to record and play back your own demonstration flights (demos). This system records your keypresses during a flight, and then uses them to fly the aircraft the same way you did when the demo was initially recorded.

IMPORTANT NOTE: The demo recording system records keypress inputs only. You cannot use a joystick, control yoke, or mouse when recording a demo flight.

To record a demo flight, place the aircraft at the location from which you wish to begin recording and set all simulation parameters as desired (time of day, environmental settings, etc.). The aircraft may be sitting on a runway or may be in mid-flight when you begin recording the demo.

Press [Alt][I] to start demo recording. When the demo flight is over, press [Alt][O] to stop recording. A message will appear on the screen asking you if you want to see the demo flight. Respond yes or no as desired. You will then be asked if you want to save the demo to disk. If you answer yes, you will be prompted to assign a filename to the demo. (If you are running ATP from floppy disk, make sure that the disk is not write-protected before you attempt to save the demo recording.) The demo will be saved to disk with the filename you specify.

Demos are recorded with one sample per second positioning. You can press [Alt][T] after you start demo recording to change the recording interval to five or fifteen seconds. The current recording interval is listed in the lower left corner of the 3D window display. The demo recording interval may also be set by selecting option 5, Demo Library, from the [F1] Flight Modes menu. This is the preferred method for adjusting the recording interval, because you can specify the interval you want to use before starting to record a demo flight.

The demo library sub-menu is also used to play back prerecorded demo flights. Refer to the "Demo Library" section of Chapter 10 for additional demo recording interval adjustment information and demo playback instructions.

Slew Mode

Slew mode lets you move very quickly and efficiently through the ATP "world", viewing the scenery along the way. You can instantaneously stop the aircraft in mid-air at any time, and change your heading, bank and pitch attitudes to look around as desired.

Press [Alt][S] from normal flight mode to toggle the slew mode system on. Your current North and East coordinate location will be listed at the top of the 3D window, and all scenery will continue to be displayed as usual.

Use the following keys to control aircraft movement and orientation in slew mode:

Function	Keyboard	Keypad
move forward/backward		[8]/[2]
move left/right		[4]/[6]
move up/down	[Q]/[A]	
pitch up/down	[9]/[0]	
bank left/right		[7]/[9]
yaw left/right		[1]/[3]
stop all motion		[5]
reset pitch/bank/heading to zero	[Z]	
digits on/off toggle	[D]	

Note that pressing the [Z] key while in slew mode automatically reorients your aircraft to a straight and level attitude at a 0° heading. Note also that you can press the [D] key to toggle the North and East coordinates on and off as desired.

Your rate of movement (either through 3D space or along an aircraft axis of rotation) increases with each press of the appropriate slew mode control key. Pressing the opposite control key decreases your rate of movement, and pressing the keypad [5] key stops all aircraft motion.

You can also use joystick A or a mouse to control several slew functions. Move the joystick or mouse forward/back to move the aircraft forwards or backwards. Move the joystick or mouse left/right to turn the aircraft to the left or to the right. Press the joystick firebutton or the left mouse button to stop all aircraft motion.

Exit slew mode by again pressing [Alt][S]. You will be returned to normal flight mode at your current location, and the aircraft will resume doing what it was doing when you entered slew mode. If you are sitting on the ground with engines off, and you enter slew mode and slew to a high altitude, the aircraft will begin to fall out of the sky when you exit slew mode. If you are flying when you enter slew mode, you can slew to a new location and resume flight there.

Time Acceleration

Flight Assignment: A.T.P. lets you accelerate the passage of time up to 16X normal speed. This feature is useful for condensing the cruise portion of long intercontinental flights, when little aircraft control input is required. Use the following keystroke combinations to adjust time as desired:

Function	Keys (keypad)
accelerate time	[Alt][+]
decelerate time	[Alt][-]
16X time	[Alt][Ins]
reset 1X time	[Alt][Del]

Each [Alt][+] keypress doubles the rate at which time passes. You will see the aircraft clock speed up with each keypress. Use [Alt][-] to slow the accelerated passage of time by a factor of two. You cannot decelerate time below 1X (normal speed). The time speed indicator box on the primary instrument panel (see Figure 3.1) shows the current time compression factor in effect.

You can still fly the aircraft at accelerated time speeds. Do not use the time acceleration feature while performing low-altitude and/or critical flight maneuvers (e.g., final landing approach). Reduce time acceleration back down to 1X to use menu functions. In single and career flight assignment modes, reduce time acceleration to 1X when communicating with Air Traffic Control (ATC).

Some computers cannot accomodate the full range of time acceleration. The fastest acceleration factor your computer can handle will vary depending on computer type, processor type, processor speed and other variables. If your out-the-window view appears to "freeze up" at faster time acceleration settings, you can try using one or both of the following procedures to fix the problem; press [Alt][W] to turn off engine sounds, or reduce the scenery complexity level and/or turn off objects on the [F5] Graphics menu. If neither of these options solves the problem, reduce the time

acceleration factor (down to 4X or less) until the the display again functions correctly. Take note of the maximum time acceleration rate that your computer can accomodate, and do not exceed this rate.

Visual Attitude Indicator

A visual attitude indicator (VAI) may be superimposed over the cockpit forward view window to help you properly orient and/or align the aircraft during various flight maneuvers. Press [Alt][A] to toggle the visual attitude indicator on and off:

Function	Keys
visual attitude indicator on/off toggle	[Alt][A]

When turned on, the VAI plots horizontal pitch orientation markers in the center of the cockpit forward view at 0°, 2.5°, 5°, and 10° that correspond with the recommended aircraft pitch attitudes for varying flight regimes. The VAI also plots 30° angled roll orientation markers on both sides of the cockpit forward view to help you make 30° banked turns to the left or right, and a runway target bracket in the center of the cockpit forward view to help you set up a landing approach path to the runway.

Scenery Display Options

The type, amount and complexity of scenery displayed in the selected 3D window can be adjusted directly from normal flight mode. You can also load other scenery from optional SubLOGIC Scenery Disks or converted scenery files located on your hard drive. The following scenery display options may be selected as you fly the aircraft, to optimize the display at each stage of your flight:

Function	Keys
cruise scenery mask (all objects enabled)	[Alt][;]
maneuver scenery mask (reduced objects, same complexity)	[Alt][']
final approach scenery mask (high-speed runway scenery only, increased complexity)	[Alt][Enter]
decrease image complexity	[Alt][<]
increase image complexity	[Alt][>]
auto complexity on/off toggle	[Alt][/]
shader on/off toggle	[Alt][Caps Lock]
scenery load	[Alt][L]

Several scenery "masks" may be used to adjust scenery details as appropriate for each stage of a typical aircraft flight. These masks turn scenery objects on or off and adjust scenery complexity levels so that only those details important to your current flight requirements will be displayed.

Press [Alt][;] while in normal flight mode to select the cruise scenery mask. This option turns on all classes of scenery objects and displays them at the currently specified level of complexity. The cruise scenery mask is intended to be used while flying at cruise altitude (when frame rate is not a critical concern) to enhance simulation realism.

[Alt]['] is used to select the maneuver scenery mask. This option turns off many classes of scenery objects to speed up the scenery display frame rate. The maneuver scenery mask is meant to be used while performing low-altitude flight maneuvers, when fast screen updates are critically important for good aircraft control.

A final approach scenery mask may be selected by pressing [Alt][Enter]. This mask turns off all scenery objects except airport runways, and increases the complexity level of the runway display to enhance both frame rate and display realism during a final landing approach.

Four keyboard-selectable scenery display options (decrease image complexity, increase image complexity, auto complexity, and shader) also may be adjusted on the [F5] Graphics menu. Graphics menu options are described in Chapter 13. Please refer to the appropriate sections of Chapter 13 for instructions on how to use these scenery display options.

The scenery load option is used to turn on the scenery library sub-menu. This menu also may be turned on by selecting option 1, Scenery Library, on the [F7] Flight Planning menu. Refer to the "Scenery Library Options" section of Chapter 15 for instructions on how to use the scenery library sub-menu to load Scenery Disks and/or scenery files.

Miscellaneous Simulation Controls

A number of other simulation control functions may be performed directly from normal flight mode. These functions are described in the chapters indicated, but it is appropriate to list them here because they are properly classified as simulation controls, and must be performed while holding down the [Alt] key.

Function	Keys
instant replay (Chapter 10)	[Alt][P]
enable/disable keyboard flight control input (Appendix II)	[Alt][K]
enable/disable joystick/yoke flight control input (Appendix II)	[Alt][J]
calibrate joystick/yoke (Appendix II)	[Alt][N]
enable/disable mouse flight control input (Appendix II)	[Alt][M]
exit the program (from normal flight mode) (Chapter 1)	[Alt][X]
load Hotkey modes 1-9 (Chapter 11)	[Alt][Ctrl][1]-[Alt][Ctrl][9]
reset to start of currently loaded flight mode (Chapter 11)	[Alt][Ctrl][0]

10 Flight Modes Menu

This chapter describes the [F1] Flight Modes menu options. The [F1] Flight Modes menu is used to select auto flight mode, select single and career flight assignments, and return to normal flight mode from these applications. Other [F1] Flight Modes menu options let you play back, delete and rename prerecorded demo flights, display an instant replay of the final seconds of your flight, and exit the ATP program.

Auto Flight Mode

Press [F1] to select the Flight Modes menu (see Figure 10.1). A + symbol before option 1, Free Flight, indicates that the simulation is currently in normal flight mode. This is the default standard operating mode that loads when you press [Esc] to exit the ATP demonstration program.

Auto flight mode can be used to take the aircraft of your choice on a flight from one of the 26 major airports included with ATP to any other major airport. You can select your own departure and destination airports, or select any one of 96 pre-programmed career flight assignments (see Chapter 17) to watch the simulation fly that career assignment in auto flight mode. If you are going to select the departure and destination airports in auto flight mode, you may want to manually set aircraft type, time of day, and other environmental and simulation parameters as desired before selecting the auto flight option. These parameters are automatically adjusted, and cannot be changed, if you decide to preview one of the career flight assignments in auto flight mode.

FLIGHT MODES (F1)

1 + Free Flight
2 Auto Flight
3 Single Assignment
4 Career Asignment
5 Demo Library
6 Instant Replay
7 Quit

(Press ESC to Exit)

Figure 10.1. Flight Modes Menu

Select option 2, Auto Flight, to put the aircraft in auto flight mode. You will be presented with a departure selection sub-menu. Select a departure airport from among the list of 26 primary ATP airports by pressing the appropriate key [A] through [Z], or press the keyboard [1] key to select a career flight assignment and enter a number from 1 to 96 followed by [Enter] to load the pre-programmed data for a specific career assignment. (See the "Career Flight Assignment Airports & Aircraft" list at the end of Chapter 17 for a description of each career assignment.) Press [Esc] to continue. If you've specified a departure airport, another sub-menu will appear from which you can select a destination airport. Select a (different) destination airport and press [Esc] to watch the simulation fly the aircraft from departure to destination. The time acceleration feature is still active when in auto flight mode, so you can speed up the passage of time to view long-distance flights in a relatively short period of time.

Select option 1, Free Flight, on the [F1] Flight Modes menu to cancel auto flight and return to normal flight mode.

Single Assignment

Flight Modes menu option 3, Single Assignment, is used to select and fly a single flight assignment. Single flight assignments are described in Chapter 17.

You can select [F1] Flight Modes menu option 1, Free Flight, at any time to cancel a single flight assignment and return to normal flight mode.

Career Assignment

Use Flight Modes menu option 4, Career Assignment, to select and fly a new career flight assignment. Career flight assignments are described in Chapter 17.

You can select [F1] Flight Modes menu option 1, Free Flight, at any time to cancel a career flight assignment and return to normal flight mode.

Demo Library

ATP allows you to record your own demonstration flights (refer to the "Demo Recording" section of Chapter 9 for instructions on how to create a demo and save it as a demo file). The demo library sub-menu lets you play back prerecorded demos, continuously cycle through a single demo playback, rename or delete old demo files, and specify the recording interval when creating a new demo.

Demo Playback

Press [F1] to select the Flight Modes menu, then select option 5, Demo Library. Available demo files are listed in the Available Demos column on the right side of the demo library sub-menu. A + symbol indicates the currently selected demo file.

Use option 1, Next Available Demo, to cycle through and select any of the demos listed in the Available Demos column. The + symbol moves down one row with each keypress to indicate the selected demo. You must select a demo file before you can play it or perform any operations on it.

Up to five demo names may be displayed at one time. Use option 2, More Available Demos, to list additional available demos as necessary. Select option 2 repeatedly to cycle through the lists and locate the demo you want to select for playback.

Select option 6, Start Demo:, to play back the selected demo. Note that the name of the selected demo is listed after the option name, to indicate which demo will be played when this option is selected.

The keyboard is locked out so you can't interfere with a demo playback as it controls the aircraft. You can end the demo at any time by pressing [Esc]. A "Demo Finished" message will appear and the simulation will pause. Press [Esc] again to return to normal flight mode, then press [P] to unpause the simulation.

Demo Looping

Use option 5, Demo Loop, to continuously replay a demo. A + symbol next to this option indicates that the demo you select for playback will cycle over again when it is finished. Toggle this option off (no + symbol) to specify a single demo playback.

Select option 6 as usual to begin demo playback. Once the demo begins playing, you can press [Esc] at any time to break out of the continuous demo loop. Press [Esc] again to return to normal flight mode, then press [P] to unpause the simulation.

Renaming a Demo

Select option 3, Rename Demo:, to rename the selected demo on the Available Demos list. The field to the right of the option name will open and a cursor will appear. Type a new name for the demo file (to a maximum of eight characters) and press [Enter]. The new name will be saved to disk. If you are running ATP from floppy disk, make sure that the disk is not write-protected when using this option.

Deleting a Demo

Select the demo you want to remove from the Available Demos list, then select option 4, Delete Demo:, to delete it from the program disk (make sure that your disk is not write-protected). Be careful not to delete the wrong demo file; a deleted demo cannot be recovered. This option is useful for eliminating old demo files from the demo library sub-menu.

Setting the Demo Recording Interval

Demos are recorded with one sample per second positioning. Option 7, Recording Interval:, may be used to change the recording interval to five or fifteen seconds. The advantage of recording at five or fifteen-second intervals is that the demo file size will be only about 1/4 to 1/10 the size of a one-second interval file. One-second intervals are good for recording fast action, and fifteen-second intervals for recording long navigation-type flights.

Use option 7 to cycle through and specify a 1, 5, or 15-second recording interval before you begin recording a demo from normal flight mode. You can also adjust the recording interval directly while recording a demo by pressing [Alt][T] to cycle between 1, 5, and 15 seconds. The current recording interval is listed in the lower left corner of the 3D window display. Refer to the "Demo Recording" section of Chapter 9 for additional demo recording instructions.

Instant Replay

Your position is constantly recorded as you fly the aircraft. An instant replay feature lets you review the last few seconds of your flight.

Press [P] to pause the simulation. Press [F1] to select the Flight Modes menu, then select option 6, Instant Replay, to turn on the instant replay sub-menu. This menu will tell you how many seconds of flight information are available. If the amount of replay time is acceptable, press [Esc] to exit the menu and view the replay of your flight. If you want to adjust replay time, select option 1, Replay Seconds Set:, type the number of seconds of replay you want to see followed by [Enter], then press [Esc] to view the replay. Press [Esc] again if you want to exit an instant replay before it is finished.

Option 2, Auto-Loop, can be set to provide a continuously running replay. Toggle this option on (+ symbol) to have the replay cycle over again when it is finished, or off to view a single replay. Press [Esc] at any time to break out of a continuous replay loop.

Option 3, Replay Speed In %:, lets you adjust replay speed from 20% to 255% of the normal playback rate. Type a percentage followed by [Enter] to set replay speed.

When you want to return to normal flight mode, press [Esc] to exit the instant replay menu, then press [P] to unpause the simulation.

You can also view an instant replay of your flight by pressing [Alt][P] in normal flight mode.

Exiting the ATP Program

Select [F1] Flight Modes menu option 7, Quit, at any time to exit from the ATP program and return to DOS.

11 Mode Library Menu

This chapter describes how to use the flight modes and hotkey modes available to you on the [F2] Mode Library menu, how to create your own flight and hotkey modes, how to rename or delete flight modes, and how to specify a new default startup flight mode.

Any adjustments you make to the [F2] Mode Library menu are saved to disk. If you are running ATP from floppy disk, make sure that the disk is not write-protected when using this menu. Flight mode changes, additions or deletions cannot be saved to a write-protected disk.

Flight Modes

A flight mode is the starting point of a flight. A flight mode specifies where your aircraft is located at the beginning of a flight, what it is doing (airspeed, direction of movement), and defines all of the simulation parameter settings currently in effect (things like time of day, clouds, winds, etc.).

A variety of different flight modes are included with ATP. Each flight mode exists as a separate mode file on the program disk (or on your hard disk). Each mode file contains information concerning aircraft type, location, orientation and altitude, aircraft control and radio settings, window settings, keyboard/mouse/joystick/yoke sensitivities, environmental settings, and other important simulation parameters.

The MODE1 flight mode is loaded when you run the ATP program. This flight mode puts you at the starting position encountered at the beginning of the simulation. The other flight modes offer a number of interesting flight situations for you to try.

Selecting a Flight Mode

Press [F2] to select the Mode Library menu (see Figure 11.1). Available flight modes are listed in the Available Modes column on the right side of the menu. A + symbol indicates the currently selected flight mode.

Use option 2, Next Available Mode, to cycle through and select any of the flight modes listed in the Available Modes column. The + symbol moves down one row with each keypress to indicate the selected flight mode. You must select a flight mode before you can load it or perform any operations on it.

Up to nine different flight modes may be displayed at one time. Use option 3, More Available Modes, to list additional available flight modes as necessary. Select option 3 repeatedly to cycle through the lists and locate the flight mode you want to select.

Loading a Flight Mode

Option 8, Reset Using Mode:, is used to load a selected flight mode. Note that the name of the selected flight mode is listed after the option name, to indicate which flight mode will be loaded when you select this option.

Select option 8, Reset Using Mode:, to load the selected flight mode, exit the Mode Library menu and place your aircraft at the starting point of the selected flight mode.

Resetting a Flight Mode

A flight mode only specifies the aircraft and simulation parameters in effect at the beginning of a flight. Once you've loaded a new flight mode, you are free to fly the aircraft and/or adjust the simulation parameters in any way you like.

To return to the starting point of the flight mode, select the Mode Library menu (press [F2]) and select option 8 again to reset the selected flight mode. This puts you back at the starting point of the flight. Alternatively, you can reset to the starting point of the currently loaded flight mode at any time directly from normal flight by pressing [Alt][Ctrl][0].

Creating a New Flight Mode

Flight Assignment: A.T.P. includes a variety of prerecorded flight modes. You can also create and save your own flight modes. The number of flight modes you can save to disk is limited only by disk size.

MODE LIBRARY (F2)

		Hotkey Modes		Available Modes
1	Next Hotkey Mode	Ctrl/Alt/1:	MODE1	+ MODE1
2	Next Available Mode	Ctrl/Alt/2:	+ LMLVIS	LMLVIS
3	More Available Modes	Ctrl/Alt/3:	LMLINS	LMHVIS
4	Set Hotkey Mode	Ctrl/Alt/4:	LMHVIS	LMSFOFIN
5	Rename Mode: MODE1	Ctrl/Alt/5:	LMHINS	LMSANFIN
6	Delete Mode: MODE1	Ctrl/Alt/6:	LMTO	LMLINS
7	Create Mode	Ctrl/Alt/7:	LMSFOFIN	LMHINS
8	Reset Using Mode: MODE1	Ctrl/Alt/8:	LMSANFIN	LMTO
9	Save Startup Mode: MODE1	Ctrl/Alt/9:	CGX36FIN	CGX36FIN
A	+ Use Mode Sensitivities			

(Press ESC to Exit)

Figure 11.1. Mode Library Menu

Get the aircraft into the position you want, and set all simulation parameters as desired (time of day, aircraft control, nav-radio and window settings, scenery complexity, etc.). The aircraft may be sitting still (on a runway or other ground location) or be in mid-flight (on a final landing approach, or cruising at 30,000 feet, for example). Use the Pause key (press [P]) if necessary to freeze the simulation.

Select the Mode Library menu (press [F2], and select option 7, Create Mode, to create a new flight mode. The field to the right of the option name will open and a cursor will appear. Type a name for the new flight mode and press [Enter]. Flight mode names are limited to a maximum of eight characters, and you cannot use a . (period/decimal point) character in a flight mode filename. The flight mode will be saved to disk, and will be listed along with all other flight modes in the Available Modes column on the [F2] Mode Library menu.

Mode Control Sensitivities

Keyboard, mouse and joystick/yoke control sensitivity adjustments (see Chapter 14) are saved along with all other simulation parameters when you create a new flight mode. When you select and reload the flight mode, control sensitivities are reset to these saved values. This may not be desirable if you prefer to use standard control sensitivities or a different set of sensitivity values when flying the aircraft.

[F2] Mode Library menu option A, Use Mode Sensitivities, allows you to either use or turn off control sensitivity adjustments when loading a new flight mode. A + symbol next to this option indicates that the flight mode you select and load will use the same sensitivities that were in effect when the mode was saved. Toggle this option off (no + symbol) to specify default keyboard, mouse and joystick/yoke control sensitivities when loading a new flight mode.

Renaming a Flight Mode

Option 5, Rename Mode:, lets you rename a flight mode on the Available Modes list. Select the flight mode you want to rename, then select option 5 to rename it. The field to the right of the option name will open and a cursor will appear. Type a new name for the flight mode (eight characters maximum, no periods) and press [Enter]. The new name will be saved to disk, and will be listed in the Available Modes column on the [F2] Mode Library menu.

Deleting a Flight Mode

Option 6, Delete Mode:, is used to delete a flight mode from the Available Modes list. Select the flight mode you want to remove from the list. Option 6 lists which flight mode will be deleted when the option is selected. Be careful not to delete the wrong flight mode; a deleted flight mode cannot be recovered. This option is useful for eliminating old or no longer needed flight modes from the [F2] Mode Library menu.

Changing the Startup Flight Mode

MODE1 is the default flight mode that is loaded when you exit the startup ATP demonstration program. This puts you at the starting position encountered at the beginning of the simulation. [F2] Mode Library menu option 9, Save Startup Mode:, lets you select a different flight mode to be used as the startup mode the next time you restart the simulation.

Select the flight mode you want to use as the new startup mode. Select option 9 to specify the selected flight mode as the new startup mode. Your selection will be saved to disk and the new flight mode will be loaded the next time you restart the simulation.

Menu Option Restrictions

The ATP program will not allow you to rename or delete MODE1 from the Available Modes list on the [F2] Mode Library menu, since MODE1 is the startup mode that the program must search for and load when you start the simulation. This is the only flight mode that cannot be renamed or deleted. Do not erase the MODE1.MOD file in the ATP subdirectory (or on your floppy disks).

If you specify a different startup flight mode, do not rename or delete that mode on the [F2] Mode Library menu, and do not erase it's file in the ATP subdirectory. If you delete your startup flight mode, you will have to make a new one with the same name or rename a copy of an existing mode file in order to load and run the ATP program!

Hotkey Modes

Hotkey modes are simply flight modes that may be loaded directly while flying the aircraft. They are called hotkey modes because you can use specific keystroke combinations to select and load them from normal flight without having to go through the [F2] Mode Library menu.

Nine pre-selected hotkey modes are set up and ready for you to use. These hotkey modes are listed on the [F2] Mode Library menu. Several menu options allow you to rearrange hotkey modes or specify your own hotkey modes.

Using Hotkey Modes

Press [F2] to select the Mode Library menu. Nine different hotkey modes are listed in the Hotkey Modes column (see Figure 11.1). Each hotkey mode slot is filled with a flight mode copied over to that slot from the list of available flight modes.

Each hotkey mode name is preceded by the specific keystroke combination used to load it from normal flight. For example, pressing [Alt][Ctrl][1] while flying the aircraft selects and loads the first hotkey mode. Pressing [Alt][Ctrl][2] places your aircraft at the starting point of the flight mode occupying the second hotkey mode slot, etc.

To reset a hotkey mode while flying the aircraft, simply re-press the keystroke combination used to load it. Alternatively (or if you've forgotten which keystroke combination was used), you can press [Alt][Ctrl][0] to reset to the starting point of the currently loaded flight mode.

Selecting a Hotkey Mode

Any available flight mode can be designated as a hotkey mode by copying it over to a hotkey mode slot on the [F2] Mode Library menu. Nine hotkey mode slots are available. Each slot is currently filled, but you can refill any hotkey mode slot with the flight mode of your choice.

Select the [F2] Mode Library menu and look at the Hotkey Modes column. A + symbol indicates the currently selected hotkey mode (or, more accurately, the selected hotkey mode slot). Use option 1, Next Hotkey Mode, to cycle through and select any of the hotkey modes. The + symbol moves down one row with each keypress to indicate the selected hotkey mode. A hotkey mode must be selected before you can replace it with another flight mode.

Copying a Flight Mode to a Hotkey Mode Slot

To copy a flight mode to a hotkey mode slot, you must select both the flight mode you want to copy and the hotkey mode slot you want it to occupy. The hotkey mode slot may be empty or it may already contain a flight mode.

Select option 4, Set Hotkey Mode, to copy the selected flight mode to the selected hotkey mode slot. The flight mode currently occupying that slot, if any, will be replaced with the new flight mode you've selected. The new hotkey mode may now be loaded directly from normal flight as usual by pressing the keystroke combination immediately preceding the hotkey mode name.

Any changes you make to the hotkey mode lineup are saved to disk and remain in effect the next time you restart the simulation.

Important Notes Regarding Hotkey Mode Use

When you copy a flight mode to a hotkey mode slot, any changes you make to the flight mode are reflected in the corresponding hotkey mode. If you rename the flight mode, it will also be renamed in it's hotkey mode slot. If you delete the flight mode, it will also be deleted from the hotkey mode slot. Do not attempt to load a hotkey mode from an empty hotkey mode slot or you may crash the simulation.

12 Environment Menu

The [F3] Environment menu is used to modify environmental factors external to the aircraft. This chapter describes how to set and/or override the time and date, how to use the automatic weather generation system, and how to independently adjust winds, clouds, atmospheric pressure and temperature.

Flight Assignment: A.T.P. environmental factors are closely interrelated to accurately simulate real-world conditions. Seasons and dawn/day/dusk/night transition times vary according to the day of the year you specify. Weather systems behave differently depending on the season and time of day. Aircraft performance can be affected by winds, temperature, air pressure, and other environmental factors. It is recommended that you read through this chapter to gain a clear understanding of these relationships before adjusting specific environmental parameters.

Time and Date Options

When you load and run ATP, the simulation's time and date are automatically set to your system clock settings. [F3] Environment menu options let you adjust time and date as desired, reset time and date to your system clock, and override the specified time of day to fly the aircraft under permanent day, dusk (dawn), or night lighting conditions.

Time

The ATP program automatically adjusts the visual flight conditions to correspond to the time of day listed on the aircraft clock. The clock displays time in a 24-hour format.

Press [F3] to select the Environment menu (see Figure 12.1). Select option 4, Time, to change the time on the clock. Time sub-menu options let you increase or decrease the hour and minute settings to fly the aircraft during the day, dusk, dawn or at night.

The clock can also be adjusted with the mouse directly from flight mode. Point the mouse cursor at the digit to be changed (hours, minutes or seconds) and click the left mouse button. Clicking to the left side of the hours or minutes digits decreases the time setting, and clicking to the right side increases the time. Clicking on the seconds digits resets seconds to zero.

Date

Dawn and dusk occur at the correct time for each day of the year (averaged Greenwich Mean Standard times for a viewer located at 40° North Latitude). Day-to-night and night-to-day transition times vary widely depending on the date. On December 21 (the shortest day of the year) only nine hours of full daylight are available, while on June 21 the full day is fourteen hours and twenty minutes long.

The duration of the dawn and dusk transition periods also vary with the season. Dawn and dusk each last only twenty minutes on December 21; by June 21 both dawn and dusk are a full forty minutes in length. The transition from full day to full night occurs in six discrete steps, going from a bright blue sky and multi-colored ground patterns to a black star-filled sky with city and airport lights the only discernable ground features. These steps are repeated in reverse for the dawn transition from night to day.

While dawn and dusk begin at a different time each day, the following list of representative transition times may give you some idea of what you can expect at different times of the year:

Date	Dawn	Day	Dusk	Night
December 21 (winter solstice)	7:18	7:38	16:38	16:58
March 21 (vernal equinox)	5:53	6:23	18:03	18:33
June 21 (summer solstice)	4:28	5:08	19:28	20:08
September 21 (autumnal equinox)	5:53	6:23	18:03	18:33

Select option 5, Date, to review or adjust the current time of year setting. The date submenu lets you specify any legal month/day combination. Winter, spring, summer, or fall seasonal flying conditions may be experienced by specifying an appropriate month and day.

ENVIRONMENT (F3)

1 Auto Weather: OFF
2 Day Light Control: OFF
3 Reset Time/Date
4 Time
5 Date
6 Winds
7 Clouds
8 Pressure: 00.00 Inches
9 Temperature: +00° Celsius

(Press ESC to Exit)

Figure 12.1. Environment Menu

Each season presents unique environmental flying conditions when the automatic weather generation system is turned on (see below for instructions on auto weather use). In winter months you may encounter icy runways and aircraft startup problems. Spring months bring high winds and flash thunderstorms. Hot, humid summer days increase density altitude and reduce aircraft lift.

The date also determines the type of ground patterns you will see in the northern sections of the United States. The ATP program determines if a snowy ground cover is likely for the region of the country through which you are flying at a particular time of year. When appropriate, the normal ground colors are replaced with a white snow pattern to simulate winter visual flight conditions.

Resetting the Time and Date

If you adjust the time or date to something other than the default system clock settings, you can select option 3, Reset Time/Date, on the [F3] Environment menu to automatically reset the time and date to your system clock.

Day Light Control

[F3] Environment menu option 2, Day Light Control:, may be used to override the current time of day and select a permanent day, dusk (dawn), or night flying environment. The option cycles through day, dusk, night, and off. Cycle option 2 off to turn off the permanent time of day override and return to normal visual flight conditions.

Automatic Weather Generation

Flight Assignment: A.T.P. has an automatic weather feature that can be used to generate dynamic weather systems appropriate for the time of year in which you are flying.

Press [F3] to select the Environment menu. Select option 1, Auto Weather:, to toggle the automatic weather generation system on and off. When turned on, the auto weather system actively controls all weather-related functions. You cannot adjust the winds, clouds, pressure or temperature options on the Environment menu when the auto weather system is active. Making any adjustments to these other menu options will turn off the automatic weather generation system.

When you start the simulation the auto weather system is turned off, surface air temperature throughout the ATP "world" is set to a default standard value of +15° Celsius, atmospheric pressure is set to 29.92 inches, and winds and clouds are turned off. These values remain in effect until you activate the automatic weather generation system (or until you manually change them by selecting and adjusting the appropriate [F3] Environment menu option).

When turned on, the auto weather system adjusts environmental parameters as appropriate for the specified time of year, and generates the typical types of active weather systems you are likely to encounter in different areas of the country resulting from these environmental conditions. While 100% accurate weather predictions are not possible, the following guidelines will give you some idea of the types of weather conditions you may encounter when the automatic weather generation system is activated:

Surface air temperature at every location throughout the country is separately adjusted and set to an average value appropriate for the current time of year and time of day.

Prevailing westerly winds are turned on. These winds vary in intensity depending on your altitude and the time of year.

Low and high pressure centers are generated and placed appropriately for the time of year and current environmental conditions. Up to four sets of moving low and high pressure centers may be generated. Flying through areas of varying atmospheric pressure affects your altimeter readings and the flight characteristics of your aircraft.

Low and high pressure centers produce winds that vary in intensity based on the relative difference in barometric pressures. These winds circulate clockwise around high pressure centers, and counter-clockwise around low pressure centers.

Cold and warm fronts rotate around low pressure centers. Clouds, rainstorms and thunderstorms may form and move along the front lines, and will be visible from the aircraft cockpit as you approach the front. Thunderstorms will also show up on the color weather radar screen. You should try to avoid flying through thunderstorms at all times.

When auto weather is turned on, the weather briefing you receive when starting a single flight assignment will reflect the current conditions set by the automatic weather generation system. (The auto weather system is also activated for some career flight assignments.) Keep in mind that, just as in real life, the enroute portion of the weather report is not an exact description but rather a "best estimate" of the types of weather conditions you may run into in your route of flight. ATIS will broadcast reasonably accurate weather reports at your departure and destination airports.

You can deactivate all active weather systems and return to the default standard environmental parameters at any time by selecting the [F3] Environment menu and toggling the auto weather option off. The automatic weather generation system remembers all weather conditions that were in effect when the auto weather option was turned off, and will return to those exact conditions the next time you reactivate the auto weather system.

Surface Winds and Winds Aloft

[F3] Environment menu option 6, Winds, is used to set surface winds and three levels of winds aloft. Adjusting any winds sub-menu options also turns off the automatic weather generation system (if currently turned on).

Select the option you want to set on the winds menu, type a value, then press [Enter]. Turn winds off by resetting the wind level speed value back to zero.

Surface winds may be adjusted to simulate realistic takeoff and landing conditions by specifying wind speed in knots (1 knot ≈ 1.15 miles per hour), wind direction in degrees (relative to magnetic north), and depth above ground level (AGL) in feet. Surface winds typically range from calm to 30 knots.

Three levels of winds aloft may be set by specifying a tops and bottom altitude (in feet) for each level, wind speed in knots, and wind direction in degrees (relative to true north, not magnetic north). Wind-level altitudes are measured in feet above mean sea level (MSL), not feet above ground level. Wind levels below 18,000 feet generally range from 10 to 60 knots. Above 18,000 feet, wind levels can range from a low of 30 knots to a high in excess of 100 knots!

Turbulent air conditions may be set for surface winds and all winds aloft. Enter a turbulence value between zero and ten for each level, where zero indicates smooth air and ten indicates severe turbulence.

Clouds

Option 7, Clouds, on the [F3] Environment menu is used to set and adjust two layers of clouds. Adjusting any of the clouds sub-menu options also turns off the automatic weather generation system (if currently turned on).

Select the option you want to set on the clouds menu, type a value, then press [Enter]. Two levels of clouds may be set by specifying an MSL tops and base altitude (in feet) for each cloud layer.

Use the cloud coverage option to cycle through and select a degree of cloud coverage, from 1/10 to full overcast (solid cloud coverage), for each cloud layer. A cloud layer may be turned off by setting the degree of cloud coverage to clear (no clouds), or by resetting the tops and base altitudes to zero.

Select the cloud deviation option to specify a maximum random deviation factor (in feet, positive or negative) that will be added to absolute cloud height.

Real world cloud types, coverage and altitudes vary widely. You can simulate a variety of different types of clouds by adjusting the cloud layer options accordingly. Low-altitude stratus clouds may be simulated by setting a cloud layer base altitude from 2500 to 5000 feet above ground level, setting the tops altitude 2000 to 5000 feet above the base, and selecting a relatively dense coverage (between 6/10 and full overcast). A second, similar stratus cloud layer may be placed from several hundred to several thousand feet above the first.

Mid-altitude clouds (nimbostratus, altostratus and altocumulus) typically occur in thin layers not more than 2000 or 3000 feet thick. Base altitudes can range from 6500 to 25,000 feet above ground level. Coverage density can vary widely, from 1/10 to 9/10. Adjust the cloud layer options as indicated to simulate these types of cloud layers.

A thin layer of high-altitude, widely scattered cirrus clouds may be simulated by setting a cloud layer base altitude anywhere from 30,000 to 70,000 feet above ground level, setting the tops altitude not more than 1000 feet above the base, and specifying a 1/10 or 2/10 level of coverage.

Thunderstorms

The clouds sub-menu is also used to set and adjust thunderstorms. Select the appropriate thunderstorm options to specify an AGL tops and base altitude (in feet) for thunderstorm (cumulonimbus) clouds.

Thunderstorm cloud base altitudes typically range from several thousand to 15,000 feet above ground level (AGL). Thunderstorm tops altitudes can vary from 25,000 to 75,000 feet AGL. Thunderstorm intensity increases with the height of the thunderstorm clouds (the distance from base to tops).

Use the thunderstorm coverage option to cycle through and select widely scattered, scattered, or dense coverage. Thunderstorms may be turned off by setting the degree of coverage to clear (no thunderstorm clouds), or by resetting the thunderstorm tops and base altitudes to zero.

Thunderstorms can be made to move by specifying movement direction in degrees (relative to magnetic north) and movement speed in knots.

Thunderstorms can be extremely hazardous to your aircraft. One writer has described thunderstorm clouds as "the ultimate manifestation of instability", a very appropriate description when you consider the violent winds and turbulence, lightning, large and possibly damaging hailstones, and severe icing conditions that you will encounter when flying through or even near severe thunderstorms. Take every precaution to avoid thunderstorms whenever possible.

Atmospheric Pressure

[F3] Environment menu option 8, Pressure:, lets you specify a uniform atmospheric pressure for the ATP "world". Adjusting pressure turns off the automatic weather generation system.

Select option 8 to set barometric pressure. The field to the right of the option name will open and a cursor will appear. Type a new value in inches and press [Enter]. Typical barometric pressures at sea level range between 28.90 and 32.70 inches.

Surface Air Temperature

When the aircraft is sitting stationary on the ground, the current surface air temperature is listed in the total air temperature (TAT) indicator box on the primary instrument panel (see Figure 3.1). [F3] Environment menu option 9, Temperature:, lets you specify a new uniform surface air temperature. Adjusting temperature turns off the automatic weather generation system.

Select option 9 to set a new surface air temperature. The field to the right of the option name will open and a cursor will appear. Type a new value in degrees Celsius (positive or negative) and press [Enter]. Typical surface air temperatures can vary from -20° to 40° Celsius (-4° to 104° Fahrenheit) depending on location and time of year.

13 Graphics Menu

The [F5] Graphics menu lets you custom-tailor the 3D window and map screen displays to best suit your requirements and/or to optimize the display frame rate for your computer system. You can adjust the complexity of the scenery displayed in the 3D and map windows, and specify which types (classes) of scenery details will be displayed in each window.

Auto Complexity

Press [F5] to select the Graphics menu (see Figure 13.1). Note that option 1, Auto Complexity:, is currently turned on. When you load and run ATP, the program checks your system configuration to determine how much microprocessing power is available, then automatically adjusts the complexity level of the screen display to maintain an acceptable frame rate on your computer system (see "Image Complexity" on the following page for a description of how complexity level affects screen display).

The auto complexity feature initially sets an image complexity level appropriate for a single window display, since typically the first 3D window is the only window turned on. If you turn on a second window (second 3D or map view), the auto complexity

GRAPHICS (F5)

1 Auto Complexity: ON
2 Flicker Control: Medium/Some Flicker
3 Select Current Window: 1st 3D
4 Image Complexity: Very Complex

A + Cities
B + Roads/Railroads
C + Rivers/Lakes
D + Major Waters
E + Airports
F + Buildings/Obstruc.
G + Mountains
H + Taxiways
I + Ground Texture
J + Shader
K + Stars

(Press ESC to Exit)

Figure 13.1. Graphics Menu

feature may decrease the complexity level in both window displays accordingly to maintain an adequate frame rate. When you turn off the second window, the image complexity level in the remaining window again may be readjusted.

You can disable the auto complexity feature at any time by selecting option 1, Auto Complexity:, to turn off auto complexity. The auto complexity option will be turned off automatically if you override the ATP program's default complexity level settings by using [F5] Graphics menu options 3 and 4 (see descriptions below) to select and then manually adjust the image complexity level in one or more window displays. Keep in mind that overall simulation frame rate decreases as more windows are turned on and as image complexity levels are increased. Select option 1 to turn the auto complexity feature back on and let the program automatically determine the proper complexity level settings for the window display configurations you set.

Auto complexity is a global simulation display feature that affects all window displays; you cannot turn off auto complexity in one window and leave it on in another. It's important to remember that the auto complexity feature's sole function is to provide an acceptable frame rate in the turned on windows. The auto complexity option is automatically turned off if you manually adjust the image complexity in any window.

Auto complexity can also be turned on and off directly from normal flight mode. Press [Alt][/] to toggle auto complexity on or off while flying the aircraft.

Window Selection

Use [F5] Graphics menu option 3, Select Current Window:, to select the window you want to adjust. Option 3 cycles through first 3D, second 3D, and map window views.

Each window may be adjusted separately for image complexity level and the types of scenery displayed. Any image complexity and/or scenery display adjustments you make apply to the selected window only.

Image Complexity

Use [F5] Graphics menu option 4, Image Complexity:, to override the ATP program's current complexity level setting for a window display. Remember to specify which window you want to adjust (use option 3) before selecting this option.

Option 4 cycles through five levels of image complexity: very sparse, sparse, medium, complex, and very complex. The initial image complexity level is set by the ATP program, based on the type of microprocessor your computer has and how fast it can perform the calculations needed to update the screen display.

The image complexity option determines how the selected classes of scenery objects in each window will be displayed (see below, "Scenery Detail Adjustments"). For example, only two or three buildings might be visible while flying over a major city when the image compexity level is set to very sparse. Fly over the same city at the highest complexity level and you may see as many as forty buildings. Airports display only the bare minimum of scenery details at a very sparse complexity level, but show complete runway markings and landing lights at the very complex image level.

Each window (first 3D, second 3D, and map view) may be adjusted to display a different level of image complexity. A very sparse complexity level is usually adequate for the map display (except possibly when taxiing around airports).

Remember that the auto complexity option will be turned off when you adjust the image complexity level in any window. When multiple windows are turned on, you may be able to compensate for this by increasing the complexity level in one window while decreasing it in another, so that net overall frame rate remains within acceptable levels when you turn the auto complexity feature back on.

Image complexity can also be adjusted directly from normal flight mode. Press [Alt][<] to decrease image complexity in all turned on windows by one level, and press [Alt][>] to increase image complexity one level. Using [Alt][<] or [Alt][>] to decrease or increase image complexity while flying the aircraft automatically turns off the auto complexity feature (if currently on).

Scenery Detail Adjustments

Use [F5] Graphics menu options A through K to turn on or off entire classes of scenery objects or details in the selected window display.

Each of the options A through K lists a different class of scenery objects that may be independently turned on or off by pressing the appropriate key. A + symbol indicates that the scenery is turned on. All classes of scenery objects are initially turned on when you load and run the ATP program.

Options A through K allow you to separately adjust the types of scenery displayed in each window. For example, you might leave all classes of scenery objects turned on in the first 3D window, adjust the second 3D window to display very complex airport scenery only (for use as the primary window display during final landing approach), and set the map window to display cities, roads, rivers and other topographical features that can provide useful visual navigation cues during a long cross-country flight.

The following types of scenery can be turned on or off in each window display:

Cities

Over 500 cities are correctly located across the continental United States. Select option A to toggle all solid-filled city outlines on or off.

Roads & Railroads

Select option B to toggle all major interstates, roadways and railroad lines on or off.

Rivers & Lakes

Select option C to toggle all river and lake scenery on or off.

Major Waters

Select option D to toggle on or off all coastal ocean scenery. This option can also be used to turn on/off the five Great Lakes and the Great Salt Lake when flying through the appropriate sections of the country.

Airports

Over 350 airports are included in the ATP scenery database. Select option E to toggle all airports on or off.

Buildings & Obstructions

The forty tallest buildings and twenty tallest transmitter towers are displayed in all twenty-six major cities (at the highest image complexity level). Select option F to toggle all buildings and transmitter towers on or off.

Mountains

Most major mountain ranges in the United States are accurately situated at the proper altitudes. Select option G when flying through mountainous regions of the country to toggle mountains on and off.

Taxiways

Airport taxiways are available at the twenty-six major airports. These taxiways are treated as a separate class of scenery distinct from airport runways. They may be turned off when making a final landing approach to improve the frame rate of the airport runway display. Select option H to toggle taxiways on or off. Taxiways are automatically turned off when you turn off airport scenery.

Ground Texture

A variety of different types of ground texture patterns are displayed in different areas of the country as appropriate to increase realism and provide a feeling of depth when flying at altitude. Select option I to toggle ground texture patterns on or off.

Shader

Solid shaded 3D objects and scenery details are displayed when the shader option is turned on. When turned off, scenery objects/details are displayed as wire-frame outlines, resulting in a faster overall frame rate. Select option J to turn the shader option on or off.

The shader option may also be toggled on or off directly from normal flight mode by pressing [Alt][Caps Lock] when flying the aircraft.

Stars

Select option K to turn stars on or off in the night display. Stars are realistically displayed in three levels of magnitude, and real constellations are visible.

Flicker Control

On some display adapters, frame rate can be increased if you're willing to tolerate some display flicker as the screen image is updated. Conversely, flicker can be reduced or eliminated by decreasing the frame rate.

Option 2, Flicker Control, on the [F5] Graphics menu cycles between slower/no flicker, medium/some flicker, and faster/much flicker frame rates. This option may be used to select the best frame rate/display flicker tradeoff when running the ATP program on systems using the following graphics adapter/monitor combinations:

- EGA 320x200 16-color RGB
- EGA/VGA 640x350 16-color high-res
- IBM PS/2 320x200 16-color
- Hercules, EGA 640x350 monochrome

Other graphics adapter/monitor combinations are not affected by the flicker control option, and will show no difference in frame rate or display flicker regardless of the flicker control setting.

The flicker control option applies to all three window displays, and cannot be separately adjusted for the different 3D and map window views.

14 Aircraft Menu

The [F6] Aircraft menu is used to select the type of aircraft you wish to fly, and to set or adjust a variety of aircraft systems and controls. This chapter describes how to select an aircraft, how to adjust crash detection and aircraft control realism, how to set aircraft fuel/payload weights, and how to adjust keyboard flight control sensitivities.

Aircraft Library

Press [F6] to select the Aircraft menu (see Figure 14.1). Select option 1, Aircraft Library, to turn on the aircraft library sub-menu. This menu is used to specify the type of aircraft you want to fly. Five different types of commercial transport aircraft are available: the Boeing 737 (the default aircraft loaded when you run ATP), Boeing 747, Boeing 767 and Airbus A320 jet airliners, and the Shorts 360 twin-engine turboprop aircraft designed for short-runway takeoffs and landings. Press a key to select the aircraft you want to fly, then press [Esc] to return to normal flight mode.

Each aircraft's primary and secondary instrument panels are laid out differently as per the manufacturer's guidelines; several of the aircraft employ a modern "glass cockpit" CRT display for some of the primary flight instruments. (The Shorts 360 has no secondary instrument panel.) Aircraft flight characteristics also vary by aircraft. The Airbus A320, in particular, has a different "feel" because of its fly-by-wire flight control systems. Refer to Chapter 18 for a more detailed discussion of aircraft differences and flight characteristics. Use the ATP Quick Reference Handbook (QRH) to determine the approximate flight control settings to use at each stage of flight for the aircraft you've selected.

AIRCRAFT (F6)

1 Aircraft Library
2 Crash: OFF
3 Aircraft Control: Real
4 Aircraft Loading
5 Mouse Sensitivity
6 Joystick/Yoke Sensitivity
7 Keyboard Sensitivity

(Press ESC to Exit)

Figure 14.1. Aircraft Menu

Crash Detection

[F6] Aircraft menu option 2, Crash:, is used to toggle crash detection on and off. When off, you can crash into the ground or buildings without causing any damage to the aircraft. When crash detection is turned on, the aircraft will crash and the simulation will reset to the start of the currently selected flight mode.

Aircraft Control Options

You can adjust the realism (and difficulty) of flying the aircraft by using option 3, Aircraft Control, to cycle through and select real, intermediate, or easy aircraft control. In easy aircraft control mode you will not experience any loss of lift when banking, and the aircraft pitch attitude tends to remain where you set it. The intermediate aircraft control mode provides an intermediate amount of lift loss while banking and some pitch attitude variations will occur. In real aircraft flight control mode, the aircraft performs as described in the "Aircraft Control" section of Chapter 8.

IMPORTANT NOTE: The Airbus A320 is naturally easy to fly because of its fly-by-wire flight control systems.

Aircraft Loading

Selecting option 4, Aircraft Loading, turns on a sub-menu where you can set the fuel and payload weights for your current flight. The payload/fuel loading sub-menu also lists the maximum recommended takeoff weight for the aircraft you've selected.

Keyboard Sensitivity Adjustments

[F6] Aircraft menu options 5, 6, and 7 are used to make mouse, joystick/yoke, and keyboard control sensitivity adjustments respectively.

Select option 7, Keyboard Sensitivity, to turn on a sub-menu where you can adjust keyboard sensitivities (how much effect each keypress will have) for the aircraft's aileron, elevator, and rudder flight controls. The keyboard sensitivity sub-menu has sliders that can be dragged with a mouse, or set manually be selecting the slider number on the keyboard and pressing the appropriate keyboard number key followed by [Esc]. Select a value between 1 (least sensitive) and 8 (most sensitive) for each set of flight control keys, then exit the menu and return to normal flight mode to fly the aircraft using the keyboard sensitivity settings you've selected.

Mouse and joystick/yoke calibration and sensitivity adjustments are described in Appendix II of this manual.

15 Flight Planning Menu

This chapter describes the [F7] Flight Planning menu options. The [F7] Flight Planning menu is used to load scenery from optional SubLOGIC Scenery Disks and/or scenery files. Other menu options let you position your aircraft at any airport or other starting location in the default ATP scenery, or at any Scenery Disk/scenery file location. The [F7] Flight Planning menu is also used to specify waypoints when flying an aircraft equipped with IRS (inertial reference system), review or update a flight logbook, and to specify active ILS approaches when using ATP with Instrument Pilot's Scenery sets.

Scenery Library Options

Press [F7] to select the Flight Planning menu (see Figure 15.1). Option 1, Scenery Library, is used to load scenery from a SubLOGIC Scenery Disk in drive A, to select and load DOS-compatible scenery files from the ATP subdirectory on your hard drive, and to return to the ATP default scenery database from these other scenery applications.

Loading a Scenery Disk from Drive A

Select option 1, Scenery Library, on the [F7] Flight Planning menu and insert the Scenery Disk you would like to use in drive A. Select option 1, Scenery Disk in A:, on the scenery library sub-menu. The ATP program will identify the Scenery Disk in drive A and prompt you to "PRESS ANY KEY TO CONTINUE". Press a key to load the Scenery Disk and return to normal flight mode.

FLIGHT PLANNING (F7)

1 Scenery Library
2 Position Using Lat/Lon
3 Position Using N/E
4 Locator
5 IRS Using Lat/Lon
6 IRS Using N/E
7 Logbook
8 ILS Preference: Left

(Press ESC to Exit)

Figure 15.1. Flight Planning Menu

The new scenery is now available, but you must move yourself to a location within the Scenery Disk boundaries to view it. Use [F7] Flight Planning menu option 3, Position Using N/E, (see below) to enter the North and East coordinates of an airport located in the new scenery area. Available airports and their North and East coordinate locations are listed on the sectional maps included with the Scenery Disk. Set altitude to 0. Press [space bar] to return to flight mode, and you should find yourself at the airport you've selected.

Returning to the Default ATP Scenery

Select option 2, ATP Default Scenery, on the scenery library sub-menu to reload the standard ATP scenery when you've finished exploring a Scenery Disk or scenery file area.

Other Scenery Options

See Chapter 19 for instructions on how to convert Scenery Disks to scenery files on your hard disk drive, and how to use converted scenery files with the ATP program.

Positioning the Aircraft

[F7] Flight Planning menu options 2 and 3 may be used to position the aircraft at any location in the ATP "world", or at any location on optional SubLOGIC Scenery Disks and/or converted scenery files.

Select option 2, Position Using Lat/Lon, to turn on a sub-menu that lets you specify the Latitude and Longitude coordinates of the location to which you'd like to move. The Latitude and Longitude coordinates of all airports included with ATP are listed in Appendix IV of this manual. Latitude and Longitude coordinates are expressed in terms of degrees, minutes, and seconds (e.g., 41° 56' 32"). Latitude coordinates may refer to a North (N) or South (S) hemisphere location, and Longitude coordinates may refer to a West (W) or East (E) hemisphere location. The ATP simulation will accept only North Latitude and West Longitude coordinate input. Optional SubLOGIC Scenery Disks containing scenery for other hemispheres will modify the ATP program to allow you to enter South Latitude or East Longitude coordinates as necessary.

Select the Aircraft Latitude:/Longitude: option on the menu and type a Latitude degrees value, press [Enter], type a minutes value, press [Enter] again, then type a seconds value and press [Enter] again. New values are entered in the left column of numbers; the right column shows the original settings. If a degrees, minutes or seconds coordinate value is already correct, press [Esc] or [Enter] to select it as is and move on to the next coordinate. If you make a mistake while typing a coordinate value, use the [backspace] key to back up and retype the number. Press [Esc] or [Enter] to accept the North (N) hemisphere coordinate designation. Follow the same procedure to enter an aircraft

Longitude coordinate and accept the West (W) Longitude designation. Set altitude to zero and the simulation will automatically place you at field elevation when you move to the new location. Enter a heading value in degrees, if desired, then press [Esc] or [space bar] to exit the menu and reposition the aircraft at the location you've specified.

Flight Assignment: A.T.P. is the first SubLOGIC simulation to use real-world Latitude and Longitude coordinates. Previous SubLOGIC flight simulations and Scenery Disks list airport locations in terms of a SubLOGIC-standard North and East coordinate system. [F7] Flight Planning menu option 3, Position Using N/E, lets you specify the location to which you'd like to move in terms of standard SubLOGIC North and East coordinates.

Both aircraft positioning menus also let you place the control tower at or near your newly-specified location. You can manually reposition the tower at a Lat/Lon or N/E location near your aircraft, or copy the aircraft coordinates to the control tower and move it to your exact location.

Select [F7] Flight Planning menu option 4, Locator, to turn on an airport locator sub-menu that may be used to instantly transport your aircraft to the terminal ramp at any of the 26 major airports included with the ATP program. Select an airport from the 26 airports listed on this menu.

Setting and Tracking IRS Waypoints

ATP aircraft (with the exception of the Boeing 737) are equipped with an inertial reference system (IRS), a navigation instrument that may be used to track waypoints defining a flight route. Waypoints are simply coordinate locations (Latitude/Longitude or North/East) that you can specify for navigation purposes. While traditional ground-based navigation stations are expensive and fixed at a single location, the aircraft's IRS can provide spatial location information without regard to external references. This internal referencing ability allows you to place and track an imaginary "ground station" at any location you like. When the IRS is activated, the horizontal situation indicator (HSI) on the primary instrument panel can be used to track a referenced waypoint as if it were a ground-based VOR station. This option is very useful for navigating to an airport (or any other site for which you know the coordinate location) on any SubLOGIC Scenery Disk or converted scenery file.

Entering Waypoints

Before setting IRS waypoints, you should first select and load an aircraft equipped with IRS (B767, B747, A320, or Shorts 360) on the [F6] Aircraft menu. If you are going to use the IRS to track waypoints in an optional Scenery Disk or scenery file area, you should select and load the appropriate scenery beforehand as well, and move the aircraft to a location within the boundaries of that scenery area.

[F7] Flight Planning menu options 5 or 6 may be used to specify IRS waypoints in terms of either Latitude/Longitude coordinates or SubLOGIC-standard North/East coordinates respectively.

Select option 5, IRS Using Lat/Lon, to turn on an IRS waypoint entry sub-menu that lets you specify the Latitude and Longitude coordinates of up to four separate waypoints that may be tracked by any aircraft equipped with IRS. Press [1] to enter a Latitude/Longitude coordinate location for waypoint 1. Type a Latitude degrees value, press [Enter], type a minutes value, press [Enter], type a seconds value, press [Enter], then press [Esc] or [Enter] to accept the hemisphere designation. Follow the same procedure to enter a Longitude coordinate for waypoint 1. If you make a mistake while typing a coordinate value, use the [backspace] key to back up and retype the number. Use the same procedure to enter Latitude and Longitude coordinate values for waypoints 2, 3 and 4.

If you prefer, you can use [F7] Flight Planning menu option 6, IRS Using N/E, to turn on an IRS waypoint entry sub-menu that lets you specify up to four waypoints using standard SubLOGIC North and East coordinate system notation.

Use either IRS waypoint entry menu to specify waypoints that you can track along your intended flight route. When you know your departure and destination coordinates, it should be relatively easy to calculate intermediate points between the two locations. Alternatively, you can use slew mode to manually position the aircraft at intermediate points along your intended route of flight, then note and use these coordinates to define waypoints enroute to your destination. Of course, any airport, nav-aid, city, other site or object with a known coordinate location can be designated as a waypoint. Use whatever methods you prefer to determine waypoint locations.

Using the Inertial Reference System (IRS)

IMPORTANT NOTE: The Boeing 737 does not support IRS, but the other aircraft you can fly with ATP are equipped with this extremely useful navigation tool. Make sure you select an aircraft equipped with IRS so you can track the waypoints you've set.

Press [Shift][5] to select the IRS navigation function in normal flight mode. The small diamond-shaped highlight symbol will move to the lower right corner of the horizontal situation indicator (HSI), near the waypoint indicator. Press [Shift][=] or [Shift][-] to cycle forwards or backwards through W1 (waypoint 1), W2, W3, W4, and off. Your current selection is listed in the waypoint indicator, and you can use the HSI to track and/or navigate by the selected waypoint as if it were a real ground-based VOR station tuned on your NAV2 radio. The off selection turns off the IRS system, causing the HSI to revert to its normal NAV2 navigation functions.

To track the selected waypoint, you must first press [Shift][2] to reference the NAV2 radio. This allows you to use [Shift][0] or [Shift][9] keypresses to increase or decrease the omni-bearing selection heading in the OBS box located in the upper left corner of the HSI. The OBS setting that centers the CDI needle with the TO flag showing tells you what heading (bearing) you must follow to fly to the waypoint.

When you use the HSI to track a waypoint, the DME2 readout on the DME indicator will display distance in nautical miles to the selected waypoint. The RMI2 needle (the thick yellow needle) will point to the selected waypoint when the RMI2 reference selecter is set to the VOR position.

Press [Shift][5] to re-select the IRS when you want to select and track a different waypoint. Use [Shift][=] or [Shift][-] to cycle the waypoint indicator to off when you want to turn off the IRS and use the HSI to track a VOR/ILS station tuned on the NAV2 radio.

Reviewing/Updating the Flight Logbook

[F7] Flight Planning menu option 7, Logbook, is used to select the flight logbook sub-menu. You can review the contents of any existing logbook, make a new entry in an existing logbook, or create a new logbook by using the options on this menu.

Select option 1, Enter Logbook Name:, on the flight logbook sub-menu, then type a logbook name and press [Enter]. If the logbook name you've entered already exists, you can then use options 2 or 3 to make a new entry in or review the contents of that logbook. If you enter a previously unused logbook name, you can use option 2, Make Logbook Entry, to make an entry in the new logbook you've created.

A flight logbook is automatically created or appended using the pilot name you specify each time you successfully complete a flight in career flight assignment mode. If you log-in under different names and keep multiple separate careers in career flight assignment mode, a different logbook will be created and updated for each pilot name.

No flight logbook is created or appended when you fly the aircraft in normal or single flight assignment modes, but you can use the options on this sub-menu to manually create and make entries in as many different logbooks as you like, or open and make entries into any existing (career flight assignment) flight logbook.

ILS Preference Selections

[F7] Flight Planning menu option 8, ILS Preference:, is provided to let you activate various ILS approaches when flying ATP with SubLOGIC's optional Instrument Pilot's Scenery sets. (See Chapter 19 for an IPS description.) Many airports throughout the U.S. have parallel runways that use the same ILS frequency (e.g., runways 24L and 24R at Los Angeles Intl LAX). In many cases these runways are too close together to make simultaneous approaches. In reality, the Air Traffic Controllers at LAX will direct an approaching aircraft to land on either the left or right runway, and will turn on the ILS transmitter for that runway ONLY.

In other cases the same ILS frequency is used at opposite ends of the same runway (e.g., runway 4 and runway 22 at New York/La Guardia LGA). Again, Air Traffic Control in reality will direct an aircraft to land at one end of the runway and will activate ONLY the appropriate ILS transmitter.

When you install and integrate Instrument Pilot's Scenery (IPS) sets into the default ATP scenery database, use option 8, ILS Preference:, to toggle between left, right, or reciprocal ILS activation at airports where these conditions occur. Toggle the ILS Preference option to left or right to activate the left or right ILS transmitter respectively at parallel runways. When both ends of the same runway share the same ILS approach frequency, the ILS transmitter for the base end of the runway (runways numbered 1-18) will be active unless you specifically select the reciprocal option to activate the ILS transmitter for the opposite (reciprocal end) runway.

This option is provided specifically for those pilots who want to fly ATP with SubLOGIC's IPS East U.S. and IPS West U.S. sets, or with other future SubLOGIC scenery products that may include conflicting ILS approaches. You will not have to use this option when flying the aircraft through the default ATP scenery database, since none of the 26 primary airports included with ATP support same-frequency parallel or reciprocal runway ILS approaches. Do not use IPS scenery while flying a career flight assignment or previewing a career assignment in single flight assignment mode; the ATC model used in Flight Assignment: A.T.P. will not route you to land at any ILS approach not supported by the ATP program, and may be confused by conflicting Instrument Pilot's Scenery ILS approach data at an ATP primary airport.

16 Status Report and Help Menus

The [F9] Status Report menu and the [F10] Help menu are convenient reference tools that can be very useful to you when flying the ATP simulation. This chapter describes how to use the [F9] Status Report and [F10] Help menus.

Status Report Menu

Press [F9] to select the Status Report menu (see Figure 16.1). The [F9] Status Report menu lists a wide variety of current simulation parameters in effect, most of which are not immediately apparent from flight mode. This menu is continually updated as you fly the aircraft and use the keyboard and adjustment menus to alter the simulation. You cannot adjust simulation parameters on the [F9] Status Report menu, you can only review what current settings are in effect. The following information is provided on the [F9] Status Report menu:

Scenery Area: Indicates the currently selected scenery source. Scenery may be loaded from optional SubLOGIC Scenery Disks and/or scenery files by selecting the Scenery Library option on the [F7] Flight Planning menu. (Scenery selection is described in Chapters 15 & 19)

STATUS REPORT (F9)

Scenery Area: ATP			Aircraft: B737
Mode Name: MODE1			Fuel: 014954
Auto Weather: OFF			Total Weight: 100163
L/L Coords:	42°51'08.10"N	087°54'54.44"W	Controls: Real
N/E Coords:	17242.6474	16542.5709	Auto Coord: ON
Altitude: +000677			Keyboard: ON
Auto Complexity: ON			Stick: OFF
Scenery Mask: Cruise			Mouse: OFF

	1st 3D	2nd 3D	Map
View:	Cockpit	Cockpit	------
Zoom:	1 X	1 X	250 ft.
Complexity:	Medium	Medium	Medium

(Press ESC to Exit)

Figure 16.1. Status Report Menu

Mode Name: Indicates the currently loaded flight mode. Flight modes are selected and loaded from the [F2] Mode Library menu. (Chapter 11)

Auto Weather: Indicates whether the automatic weather generation system is on or off. Use the [F3] Environment menu to enable/disable auto weather. (Chapter 12)

L/L Coords: Lists the aircraft location in Latitude and Longitude coordinates. Use the [F7] Flight Planning menu to move the aircraft to a new Latitude/Longitude coordinate location. (Chapter 15)

N/E Coords: Lists the aircraft location in North and East coordinates. The [F7] Flight Planning menu is used to specify a new aircraft location in North/East coordinates. (Chapter 15)

Altitude: Lists the aircraft MSL (mean sea level) altitude in feet. Use [F7] Flight Planning menu option 2 or 3 to specify an aircraft altitude when moving the aircraft to a new Latitude/Longitude or North/East location. (Chapter 15)

Auto Complexity: Indicates whether the automatic scenery complexity adjustment feature is on or off. Auto complexity may be toggled on/off using the [F5] Graphics menu, or by pressing [Alt][/] in normal flight mode. (Chapter 13)

Scenery Mask: Indicates the currently selected scenery mask — cruise, maneuver, or final approach. These scenery masks may be selected from the keyboard by pressing [Alt][;], [Alt]['], and [Alt][Enter] respectively. (Chapter 9)

Aircraft: Lists the selected aircraft type. Use the [F6] Aircraft menu to select the aircraft you want to fly. (Chapter 14.)

Fuel: Indicates the quantity of fuel remaining in pounds. Initial fuel weight is set on the [F6] Aircraft menu. (Chapter 14)

Total Weight: Lists the total weight of the aircraft. Total weight is initially determined by the aircraft type you select and the fuel and payload weights you set on the [F6] Aircraft menu. (Chapter 14)

Controls: Indicates the aircraft control mode in effect — easy, intermediate, or real. Aircraft control mode is selected on the [F6] Aircraft menu. (Chapter 14)

Auto Coord: Indicates whether the auto-coordination feature is on or off. This feature is toggled on and off from the keyboard by pressing the [/] key. (Chapter 5)

Keyboard: Indicates whether keyboard-based flight control input is turned on or off. You can press [Alt][K] to turn off keyboard input when using joysticks or a mouse to fly the aircraft. (Appendix II)

Stick: Indicates whether optional joystick/yoke flight control input is turned on or off. Press [Alt][J] to enable/disable joystick or yoke flight control input in normal flight mode. (Appendix II)

Mouse: Indicates whether optional mouse flight control input is turned on or off. Press [Alt][M] to enable/disable mouse flight control input in normal flight mode. (Appendix II)

View: Indicates the current view mode displayed in the first and second 3D windows — cockpit, tower, or spot. Use [Shift][Caps Lock] to cycle through cockpit/tower/spot view modes in the selected 3D window. These view modes may be displayed only in 3D windows, so no view mode is listed in the map column. (Chapter 6)

Zoom: Indicates the current zoom factor in effect in the first 3D, second 3D, and map windows. Press [Shift][+](keypad) or [Shift][-](keypad) to zoom in or out respectively in the selected window. Press [Shift][N] to reset the selected window zoom factor to 1X (normal view). (Chapter 6)

Complexity: Indicates the current image complexity level in effect in the first 3D, second 3D, and map windows. Press [Alt][>] or [Alt][<] to increase or decrease image complexity level respectively in all active windows. Each window's image complexity level also may be adjusted separately on the [F5] Graphics menu. (Chapter 13)

Help Menu

Press [F10] to select the Help menu. This menu lists all of the other menus available in Flight Assignment: A.T.P. and the keys used to select those menus. Use the [F10] Help menu as a quick reference guide to determine which other menu contains the simulation parameter you want to adjust.

17 Welcome to SubLOGIC Airlines

Flight Assignment: A.T.P. provides two structured activity modes: single flight assignment mode, and career flight assignment mode. The single flight assignment mode lets you select your own departure and destination airports, or fly (preview) any one of 96 pre-programmed career flight assignments without affecting your cumulative career flight assignment rating. Single flight assignment mode also allows you to adjust weather, time of day, and other environmental and simulation control factors as desired.

The career flight assignment mode in ATP is not a game, but a structured activity that can provide many months of enjoyment and personal satisfaction as your skills improve over the course of flying 96 consecutive career flight assignments. Each pilot will fly the same predefined assignment at the corresponding career flight assignment number, so you can compare notes with other pilots on a specific flight knowing that your assignments were the same.

Before you begin flying for SubLOGIC Airlines, you may want to review the "Communications and Air Traffic Control" section of Chapter 8. Single and career flight assignments require you to communicate with a number of different ATC controllers, and Chapter 8 describes these procedures in some detail for a sample flight assignment from Los Angeles to San Diego.

Single Flight Assignment

If you are going to select your own departure and destination airports in single flight assignment mode, you may want to manually set time of day and adjust weather options as desired (or select automatic weather generation) before selecting the single flight assignment option. If you decide to preview one of the 96 career flight assignments in single flight assignment mode, these parameters are automatically adjusted for you since they are an integral component of the pre-programmed career flight assignment.

Single Flight Assignment Menu Selections

Press [F1] to select the Flight Modes menu, and select option 3, Single Assignment, to begin a single flight assignment. You will be presented with a departure selection submenu. Select a departure airport from among the list of 26 primary ATP airports by pressing the appropriate key [A] through [Z], or press the keyboard [1] key to select a career flight assignment and enter a number from 1 to 96 followed by [Enter] to load the pre-programmed data for a specific career assignment. (Use this option if you'd like to preview or review a specific career flight assignment. See the "Career Flight Assignment Airports & Aircraft" list at the end of this chapter for a description of each career flight assignment's preset simulation parameters.) Press [Esc] to continue.

If you specify a departure airport on the departure selection sub-menu, you next will be presented with the destination selection sub-menu. Select a (different) destination airport from among the list of 26 primary ATP airports and press [Esc] to continue.

The flight planning sub-menu lets you select either radar vectored or radio nav-aid flight navigation, and prompts you to specify a requested cruising altitude. If you select radar vectored navigation, ATC will provide you with specific heading and altitude guidance every step of the way from takeoff to final approach intercept at the destination airport. If you choose radio nav-aid navigation, you will be cleared for and assigned to follow specific jet routes leading to the destination airport. You will have to locate the assigned jet routes on the appropriate large U.S. area map, and use the map to navigate along the jet routes by tracking each VOR nav-aid along each jet route in turn. Select a navigation method, specify an initial cruise altitude (requested flight level), then press [Esc] to continue.

Use the aircraft library sub-menu to select the type of aircraft you wish to fly, then press [Esc]. Write down all weather information provided on the weather briefing sub-menu, then press [Esc] again to move on to the payload/fuel loading sub-menu. Use this menu to set payload and fuel weights, in pounds, up to the maximum recommended takeoff weight for the aircraft you've selected. (If you are previewing a career assignment in single flight assignment mode, only fuel weight may be set on this menu.) Load fuel to maximum capacity until you're experienced enough to accurately judge how much fuel you will need for a given flight based on aircraft type and weight, cruising altitude and airspeed, estimated time of flight, weather conditions, and other factors that may affect your flight time. You'll receive the best safety rating when you are able to land at the destination airport with one hour's worth of fuel left in your tanks. Specify payload and fuel weights, then press [Esc] to start the single flight assignment.

Flying a Single Flight Assignment

The communications and navigation procedures involved in flying the aircraft are essentially the same in both single and career flight assignment modes. Refer to the "Flying a Career Flight Assignment" section of this chapter for a detailed description of how to fly the aircraft in flight assignment mode.

Single Flight Assignment Score

After your flight, you will be given a one-time score based on the performance factors described in the "Career Flight Assignment Score" section of this chapter.

If you fly a specific career flight assignment in single flight assignment mode, the score menu will be displayed either when you come to a complete stop at the destination airport, or one minute after you report and then execute a missed approach. (Perform the Go-Around procedures listed in the "Flight Checklist" section of the QRH to execute a missed approach.)

If you fly a single flight assignment from departure to destination airports that you've selected, you must land and come to a complete stop at the destination airport to receive a score.

Recording a Single Flight Assignment in a Flight Logbook

No flight logbook entry is made when you complete a single flight assignment. The ATP simulation makes automatic logbook entries for successfully completed career flight assignments only.

You can manually open and record your flight in any existing flight logbook, or create and make entries in a new logbook, by selecting the Logbook option on the [F7] Flight Planning menu. Refer to Chapter 15 for instructions on how to open or create a flight logbook if you want to record a single flight assignment.

Career Flight Assignment

In career flight assignment mode you are assigned a pre-programmed flight by the airline dispatcher. Weather, time of day, aircraft type, payload, and form of navigation (radar vectors or radio nav-aids) are determined for you and may not be altered. You will start out as both Commercial Pilot and the first officer (second in command) of a Boeing 737 but must do all of the flying by yourself. Your performance will be graded, you will (with any skill) advance in aircraft type ratings to the Boeing 767 and Boeing 747 aircraft, and will eventually earn your Airline Transport Pilot certificate. Career flight assignment scoring is cumulative, but is maintained separately from your flight logbook records.

Career Flight Assignment Menu Selections

Select option 4, Career Assignment, on the [F1] Flight Modes menu to begin a career flight assignment. Option 1 on the first career assignments sub-menu prompts you to enter the pilot name under which you would like to log your flight. You may log-in under any name you like (and keep multiple careers). We recommend that you log-in under a fictitious name when feeling reckless, and use your real name when seriously pursuing your career with SubLOGIC Airlines. Separate scores are kept for separate individuals. Option 3 on this menu lets you review the career standing of the pilot name you've entered. Select option 2 on this menu to begin the next flight in the logged-in pilot's career.

Use the second career assignment sub-menu to begin your next career flight assignment. If you log-in under a new pilot name, you will begin with career flight assignment #1. If you log-in under a previously used name, you will be assigned to fly the next scheduled flight assignment in your career. All pilots must fly the career flight assignments in the same sequence, from #1 through #96 (see the "Career Flight Assignment Airports &

Aircraft" list at the end of this chapter for a description of each career flight assignment's preset simulation parameters). Select option 1 on this menu to begin the listed flight assignment. Option 2 on this menu may be used to skip the listed assignment and move on to the next career flight assignment. Don't skip assignments unless absolutely necessary! Once you skip an assignment in career flight assignment mode, you've missed it. If you accidently skip a career flight assignment, you may want to start a new career under a different pilot name. This option is meant to be used only if a problem occurs with a career flight assignment that prevents you from completing the flight. Previously identified flight plans which may conflict with your computer system (check the "NOTCAM" section of the separate "Introduction to Flight Assignment: A.T.P." booklet for a listing of any identified problematic flights) can also be bypassed using this option. If you experience a problem with one of the predefined routes in career flight assignment mode, please contact SubLOGIC. We want to keep a list of any problems that need to be fixed.

Write down all weather information provided on the weather briefing sub-menu, then press [Esc] to move on to the payload/fuel loading sub-menu. Payload weight is preset for you in career flight assignment mode, and cannot be adjusted. Use this menu to set fuel weight, in pounds, up to the maximum recommended takeoff weight for the aircraft you will be flying Load fuel to maximum capacity until you're experienced enough to accurately judge how much fuel you will need for a given flight based on aircraft type and weight, cruising altitude and airspeed, estimated time of flight, weather conditions, and other factors that may affect your flight time. You'll receive the best combined safety/efficiency rating when you are able to land at the destination airport with one hour's worth of fuel left in your tanks. Press [1] and type a fuel weight in pounds followed by [Enter]. When you've finished, press [Esc] to start the career flight assignment.

Flying a Career Flight Assignment

At the start of a single or career flight assignment, your aircraft is positioned near the terminal building at the departure airport. Begin by tuning **ATIS** (Automatic Terminal Information Service) on your COM1 or COM2 radio to receive a taped ATIS message. The ATIS frequency is listed on any approach chart for the departure airport located in Appendix IV of this manual. When multiple frequencies are listed on the approach chart, use the first frequency listed for the controller (ATIS, ground, tower, etc.) you wish to contact. (You can check in with generic flight service on frequency 122.00 at any time if you're unable to determine which frequency to use to contact a specific controller.) De-tune ATIS frequency when you've finished copying down all information or it will continue to repeat itself indefinitely. In reality, several of the 26 primary airports (see the "Using Communications Frequencies" section of this chapter) use an actual ATIS frequency beyond the range of your communications radios. Tune your COM radio to the generic ATIS frequency of 127.00 at these airports.

Next, tune your COM radio to the **clearance delivery** frequency listed on the departure airport taxi chart (airport diagram). Airport taxi charts for all of the 26 primary airports are provided in Appendix IV. Press [Ctrl][X] to request clearance. While [Ctrl][tab] is generally used to check in with all newly-tuned ATC communications facilities, the [Ctrl][X] keystroke combination is used specifically to request clearance from clearance delivery. Write down all clearance information. (The "FAA Instrument Flying Handbook" provides shorthand notation for those who wish to learn it). Press [Ctrl][Enter] to acknowledge receiving and understanding the message. The clearance message will remain on the screen until you press [Ctrl][Enter] to "Roger" (readback) receipt. At any time during your flight, you can press [Ctrl][X] again to recall the clearance message.

Next you must tune the **ground control** frequency listed on any departure airport approach chart. Press [Ctrl][tab] to check in with ground control. Your check-in is interpreted automatically as a taxi for takeoff request, and you will receive instructions to taxi to a specific preferred takeoff runway. (Alternately, you can press [Ctrl][.] specifically to request taxi for takeoff from ground control.) Again, press [Ctrl][Enter] to Roger (readback) receipt of any message. Do not accept a runway assignment from ground control which would force you to takeoff in a tailwind greater than 15 knots. You will be derated and may even crash the aircraft if you attempt to takeoff with a strong tailwind. If necessary, press [Ctrl][/] to request a different runway assignment from ground control.

You can manually taxi to the takeoff runway, or press the [~] key to select the auto-taxi option which automatically places your aircraft at the preferred takeoff runway. If you have requested a different runway assignment from ground control, you must manually taxi your aircraft to the alternate runway you've selected. Perform the Before Takeoff tasks as outlined in the QRH "Flight Checklist", and remember to set the 4-digit "squawk" code on your transponder as assigned by clearance.

Tune your COM radio to the **tower** frequency listed on a departure airport approach chart and press [Ctrl][tab] to check in with tower. Your check-in is interpreted as a request for takeoff. "Hold short" or "position and hold" are two possible tower responses. If the auto-taxi option was used to position your aircraft at the preferred takeoff runway, just understand that "hold short" means that you should not taxi onto the runway. "Position and hold" means that you should taxi onto the runway, line yourself up for takeoff, then stop and wait for takeoff clearance. Press [Ctrl][Enter] to Roger tower's instructions, but do not takeoff yet.

Roger tower's "cleared for takeoff" message when it appears, and note the initial heading you are assigned to fly. Go ahead and takeoff. Follow the QRH Takeoff and Climb "Flight Checklist" procedures for gear and flap retraction, thrust reduction and climb speeds. Refer to the "Approximate Flight Settings" section of the QRH to determine which control settings and pitch attitudes to use with your aircraft. Continue to climb at 250 kts to your initial assigned altitude. Roger all messages as they appear.

After takeoff you will be handed over (assigned) to a **departure** controller. Departure will vector you around traffic, and then direct you either to the first nav-aid of the first assigned jet route (when flying by radio nav-aid navigation), or on your way direct to the destination (when using radar vectored navigation). Follow all departure instructions regarding heading changes, new center contacts, etc., and Roger each message after you've read it. Level off at the initial assigned altitude and reduce thrust according to the QRH "Approximate Flight Settings" recommendation for medium power level cruise flight. NOTE: You are only cleared to climb to the initial altitude given in your clearance. Your "expected" altitude is not your assigned altitude until specifically assigned by departure or center controllers.

Once you are well away from the airport, departure will turn you over to a **center** controller. Center will monitor and guide you through the enroute portion of your flight. During the enroute portion of your flight you will be handed off from one center controller to another. Write down each new center frequency as it is assigned, then tune and check in with the new center by pressing [Ctrl][tab]. You can press [Ctrl][Caps Lock] at any time during your flight to "request repeat last transmission" from any controller if you miss or forget to write down the message/instructions.

When flying a radar vectored flight, center will guide you all the way to the destination airport. When flying by radio nav-aid navigation, you are responsible for tuning and tracking each nav-aid in sequence that defines the assigned jet routes to your destination. Jet routes are shown on the large U.S. area charts included with the ATP program. If you get lost while flying a jet route, you can press [Ctrl][V] to request radar vectors from center to the next jet route nav-aid. Center will vector you back on track, but your overall performance rating will be lowered at the end of the flight. You will also be de-rated if you fail to ident each nav-aid in turn (press [Shift][I] to turn on and [Shift][O] to turn off ident code) after tuning it on your NAV radio.

Center controllers will assign specific altitudes for you to maintain at different stages of your flight. You can request a different altitude assignment from center at any time by pressing [Ctrl][A] and typing in a new requested flight level on the altitude request sub-menu (use of this menu is self-explanatory). Press [Ctrl][Q] to report leaving altitude whenever you begin to climb or descend to a new altitude. Remember to reset your altimeter to 29.92 when climbing through 18,000 feet.

Another enroute right is the [Ctrl][F] communication used to request a frequency change. Use this request if you must tune your COM radio away from center frequency (to contact ATIS at the destination airport, for example, or to tune generic flight service at 122.20 to determine a needed frequency). (Usually you should not have to use this option, since your aircraft is equipped with two COM radios and the second radio can be used to tune another frequency.) If you must tune away from center, remember to re-tune the last center frequency and check back in when you're finished.

Center or **approach** control will have you begin a descent as you near your destination, and will issue the local altimeter setting when you descend below 18,000 feet. Tune in destination ATIS on your unused COM radio when you are 60-70 miles from the destination airport, write down all ATIS information, and then de-tune the ATIS frequency. (It's best to tune the unused COM radio to ATIS so that you can continue to receive instructions from center on the other COM radio.) Use the first ATIS frequency listed on a destination airport approach chart to tune ATIS. If you do not receive ATIS and are passed on to the approach control facility, get ATIS first and then check in with approach control. You will be de-rated if you are very late or forget to tune destination ATIS.

Approach control will assign you a specific runway approach, and will issue vectors for you to intercept the final approach course. You may request a different approach by pressing [Ctrl][/] to request a different runway. Once you are given a heading to "intercept final approach course" you are no longer on radar vectors and are in charge of your own navigation. Approach control will turn you over to tower, usually before final approach fix. Find the appropriate ILS approach chart in Appendix IV of this manual, tune the approach frequency on your NAV radio, and don't forget to ident the localizer transmitter to confirm that you've tuned the correct frequency. When you can see the assigned runway, press [Ctrl][T] to report that the runway is in sight.

If you are on an instrument approach and still in the clouds or in a bad position to land (either localizer or glideslope needle pegged) at minimums, you must report and execute a missed approach. Press [Ctrl][M] to report a missed approach, then use pitch/power to climb, clean up the aircraft (retract gear, flaps, etc.) and climb straight ahead unless another procedure is given.

Even if tower clears you to land, you may be told to "execute a missed approach". Press [Ctrl][M] to report a missed approach. This tells the ATP simulation that the assignment is over. Execute a missed approach by following the Go-Around procedure outlined in the QRH "Flight Checklist".

After landing, the [Ctrl][,] keystroke combination may be used to request taxi to the terminal. Your flight plan is automatically terminated when you complete the flight assignment and roll to a complete stop at the destination airport.

Career Flight Assignment Score

You will receive a score in two separate categories; salary, and a composite safety/ airmanship/efficiency rating. When you begin your career flight assignment history, you will be given a salary of $15,000, credit of 250 flight hours, and a composite score of 20%. Salary is based on the following:

ATP certificate	-	$30,000
Boeing 737-type rating	-	$3,000
Boeing 767-type rating	-	$8,000
Boeing 747-type rating	-	$15,000
flight experience	-	$4.00 per flight hour

NOTE: Aircraft type ratings are only worth one half their listed value until you receive your ATP certificate.

Your composite safety, airmanship, and efficiency score is measured against a pre-determined standard.

Airmanship

Airmanship is assessed by your adherence to and observance of recommended air-speeds, assigned headings, routes, etc. Other aspects of airmanship (such as smooth-ness) may also affect your airmanship rating. Adherence to an assigned altitude will also be assessed but you can use the autopilot altitude hold function as desired.

Airmanship may be specifically de-rated on the following factors:

Failed to check ATIS:	You must check in with departure ATIS before requesting clearance, and with destination ATIS when within 50-70 miles of the destination airport.
Delays in retracting gear:	Landing gear must be retracted by 1000 feet AGL.
Airspeed low during departure:	Airspeed must be at least 220 kts by 3000 feet AGL.
Altitude deviation:	Aircraft strayed more than ± 300 feet from assigned altitude.
Heading deviation:	Aircraft strayed more than ± 5 degrees from assigned heading.
Exceeded Mach limit:	Exceeded aircraft max operating speed.
Localizer/Glideslope deviation:	Localizer needle strayed more than 2/3 left or right of center position; glideslope needle strayed more than 2/3 below or 1/3 above center position.
Failed to set transponder:	Failed to set assigned 4-digit "squawk" code on the transponder.

Efficiency

Your efficiency rating is based on the simulation's determination of the most efficient combination of fuel consumption vs. time enroute for an assigned flight. The optimal use of cruise airspeed and altitude will affect your efficiency rating.

Safety

Your safety rating will be computed on many aspects of flight, some closely related to airmanship, others related to judgments of fuel load, runway choice, etc. If you think that an improved safety rating can lower your flight efficiency rating, you are correct. However, the rating system is biased to reward moderately conservative decisions of runway choice, weather avoidance, and fuel reserve.

Safety may be specifically de-rated on the following factors:

Failure to hold before takeoff:	Executed takeoff before receiving the "cleared for takeoff" message from tower.
Takeoff tailwind greater than 15 kts:	Takeoff tailwind exceeded 15 kts.
Failed to maintain climb under 1000 ft:	Failed to maintain positive rate of climb up to 1000 feet AGL after takeoff.
Violated flaps schedule:	Used unsafe flap setting for airspeed.
Exceeded airspeed limit:	Exceeded 250 kts airspeed below 10,000 feet, or exceeded airspeed limit assigned by ATC.
Exceeded Mach limit:	Exceeded aircraft max operating speed.
Exceeded airspeed limit for gear:	Failed to retract landing gear before exceeding max gear extension speed.
Failure to ident NAV radio:	Failed to properly ident a newly-tuned VOR or ILS transmitter to confirm that the correct frequency was set and received on your NAV radio.
Failure to report missed approach:	If you peg either localizer or glideslope needle on final approach, you must report a missed approach, then execute a missed approach (go-around) within one minute.
Landed in unforecast zero zero:	Landed when runway was not visible at decision height. If you are in the clouds at minimum decision height, you must report and execute a missed approach.
Failed to do commanded go-around:	Failed to perform go-around procedure or did not follow correct go-around procedure when commanded to "execute missed approach" by ATC. You must report a missed approach, establish and maintain a positive rate of climb within 15 seconds.

Unsafe fuel level:	Landed with less that 1/2 hour of fuel left onboard the aircraft.
Unsafe plane orientation:	Indicates that the aircraft was pitched up more than 20 degrees, pitched down more than 10 degrees, or banked more than 45 degrees during the flight.

Type Ratings

In career flight assignment mode, you will be offered the option to apply for a type rating once your career composite score is up to:

B737 - 50%
B767 - 60%
B747 - 70%

You will have to pass a check ride flight performed under the following conditions:

B737 - visual conditions, winds calm
B767 - ceiling 500 feet, medium winds shifting with altitude
B747 - ceiling 500 feet, strong shifting winds on final approach course

You must receive a composite score of at least 70% in order to pass the check ride flight. After making a check ride flight, you may not take a new check ride until you have flown three more flights in career flight assignment mode.

The ATP Certificate

You may advance to your ATP certificate independent of type ratings if you meet the following requirements:

- 50 flights in the career flight assignment mode
- 12 successful approaches down to 500 feet or lower
- composite rating of 70% or greater
- be of good moral character

If you meet these requirements, you will be given the opportunity to take a particularly challenging flight with bad weather enroute, low 500' ceilings at the destination, and shifting winds on the approach. If you pass the check ride, congratulations. Besides receiving a base salary increase, you will be awarded a bonus of 1500 extra hours. If you do not pass, the option to retake the check ride will be offered again after you have flown three more career flight assignments if you maintain a composite score of at least 70% for each flight..

Career Flight Assignment Logbook Entries

The ATP program automatically creates and/or opens and records a new entry in a flight logbook, using the pilot name you specify, each time you successfully complete a career flight assignment. If you log-in under different names and keep separate careers in career flight assignment mode, a different logbook is created and updated for each pilot name.

You can review or update the contents of any flight logbook by selecting the Logbook option on the [F7] Flight Planning menu. Refer to Chapter 15 for instructions on how to review or make new entries in a flight logbook.

Flight Assignment Notes

Using Communications Frequencies

- Most of the busier airports have separate arrival and departure ATIS frequencies. Use the arrival ATIS frequency listed on any approach chart to communicate with ATIS, not the departure ATIS frequency listed on the airport taxi chart. Where multiple ground or tower frequencies are given, use the first frequency listed on the approach chart. The only frequency you will have to obtain from the airport taxi chart is clearance delivery. Remember, if you can't find the frequency you're looking for, you can check in with generic flight service on frequency 122.20.
- You must use the generic ATIS frequency of 127.00 to tune ATIS at the following primary airports:

  Dallas-Fort Worth Intl (DFW)
  Miami Intl (MIA)
  New York/John F. Kennedy Intl (JFK)
  San Francisco Intl (SFO)

  The actual ATIS frequencies used at these airports are beyond the frequency range of your COM radio. In a real commercial transport aircraft these frequencies would be tuned on one of the aircraft's NAV radios, and the ATIS message would be played through the cockpit audio system.
- The ATP simulation doesn't know which radio you're transmitting on, so you can Roger an old transmission after leaving the frequency.
- To simplify your communications tasks, we suggest using only the COM1 radio (real ATP pilots often flip-flop between radios). If you get an unexpected or incorrect ATIS message, it may be coming in on your other COM radio. Tune the second COM radio off frequency to get rid of the unwanted ATIS.
- Multiple messages may be stacked up, so when you Roger one message you may still see the same or another old message. Just keep Rogering to get rid of all messages in the stack.

Tips and Hints

- When flying a single or career flight assignment, don't hesitate to use the pause feature (press [P]) to stop the simulation whenever you like.
- The aircraft autopilot (see Chapter 5) can be very useful for helping you to maintain heading and/or altitude when flying a flight assignment. Use the autopilot in heading hold flight mode to follow the heading you set in the heading bug indicator box. When control directs you to take a new heading, simply reset the heading bug and the autopilot will automatically turn the aircraft to the new heading you've set. Similarly, the autopilot altitude hold option may be used to maintain an assigned altitude. Just remember that you must turn the autopilot altitude toggle switch off to disable the altitude hold feature when you want to climb or descend to a new altitude.
- Try using the time acceleration feature (use the [Alt]-based simulation controls) to speed up the simulation to 2X or 4X normal speed, and increase image complexity to improve the out-the-window display. When an ATC message appears on the screen, reduce time back to normal speed to read and comply with the ATC command. While it may be more realistic to fly at real time when setting radios, etc., the ATP simulation is so new that it's too early to determine what types of transfer will occur when using this simulation. Take it easy when flying your first flight assignments, and give yourself a pat on the back when you successfully complete a flight assignment under any circumstances.
- Jet route (J) clearances only list the last VOR defining that jet route. Use intermediate VORs to navigate along the jet route. An assigned jet route followed by 0X0 in the clearance delivery message indicates that you must fly that jet route to intercept another jet route on the way to your final destination.
- Flight assignments are designed to provide a gradual introduction to aircraft navigation and the different types of aircraft you can fly with ATP. These flight assignments become more difficult as you progress through the ranks, and alternate between beautiful scenic flight routes and interesting new challenges to your growing skills as an Airline Transport Pilot. In future SubLOGIC flight simulation products, we plan to open up the flight assignment design process to give professional aviation companies (and our other customers) the freedom and ability to design their own flight curriculum.

Generic Communications Facility Frequencies

The following frequency settings may be tuned on your COM radio when flying the aircraft in single or career flight assignment mode to contact the appropriate control facility:

Control Facility	Frequency
generic ATIS	127.00
generic flight service	122.20

IMPORTANT NOTE: Remember that you must use the generic ATIS frequency of 127.00 to tune ATIS at the following primary airports:

Dallas-Fort Worth Intl (DFW)
Miami Intl (MIA)
New York/John F. Kennedy Intl (JFK)
San Francisco Intl (SFO)

Communication Controls Summary

The following [Ctrl]-based keystroke combinations are used to communicate with Air Traffic Control in single and career flight assignment modes. Note that all communications must be performed while holding down the [Ctrl] key:

Communication	Keys
Roger (readback transmission)	[Ctrl][Enter]
request repeat last transmission	[Ctrl][Caps Lock]
request/verify clearance	[Ctrl][X]
check in with new ATC facility	[Ctrl][tab]
request taxi for takeoff	[Ctrl][.]
request different runway	[Ctrl][/]
request new altitude	[Ctrl][A]
report leaving altitude	[Ctrl][Q]
request frequency change	[Ctrl][F]
request radar vectors	[Ctrl][V]
report traffic/runway in sight	[Ctrl][T]
report missed approach	[Ctrl][M]
request taxi to ramp	[Ctrl][,]
cancel clearance (exit flight assignment mode)	[Ctrl][C]

Career Flight Assignment Airports & Aircraft

Assignment	Departure	Destination	Aircraft	Conditions
#01	Los Angeles (LAX)	San Diego (SAN)	B737	Day - Visual Landing Approach
#02	Los Angeles (LAX)	San Francisco (SFO)	B737	Day - Visual Landing Approach
#03	Houston (IAH)	New Orleans (MSY)	B767	Night - Visual Landing Approach
#04	Las Vegas (LAS)	San Francisco (SFO)	B737	Day - Instrument Landing Approach
#05	St. Louis (STL)	Kansas City (MCI)	B737	Night - Instrument Landing Approach
#06	Chicago (ORD)	Cleveland (CLE)	B767	Day - Visual Landing Approach
#07	Tampa (TPA)	Atlanta (ATL)	B737	Night - Instrument Landing Approach
#08	Salt Lake City (SLC)	Denver (DEN)	B737	Day - Visual Landing Approach
#09	Denver (DEN)	Kansas City (MCI)	B737	Night - Instrument Landing Approach
#10	Seattle (SEA)	Denver (DEN)	B767	Day - Visual Landing Approach
#11	Cleveland (CLE)	New York (JFK)	B737	Day - Visual Landing Approach
#12	New York (JFK)	Pittsburgh (PIT)	B737	Day - Instrument Landing Approach
#13	Pittsburgh (PIT)	Atlanta (ATL)	B737	Night - Instrument Landing Approach
#14	Miami (MIA)	Tampa (TPA)	B737	Day - Visual Landing Approach
#15	Atlanta (ATL)	Tampa (TPA)	B767	Day - Instrument Landing Approach
#16	Salt Lake City (SLC)	Los Angeles (LAX)	B737	Day - Visual Landing Approach
#17	Dallas (DFW)	Houston (IAH)	B737	Night - Instrument Landing Approach
#18	Boston (BOS)	New York (JFK)	B737	Night - Visual Landing Approach
#19	New York (JFK)	Philadelphia (PHL)	B737	Day - Instrument Landing Approach
#20	Philadelphia (PHL)	Kansas City (MCI)	B737	Night - Instrument Landing Approach
#21	Phoenix (PHX)	Salt Lake City (SLC)	B767	Day - Instrument Landing Approach
#22	New York (JFK)	Boston (BOS)	B737	Night - Visual Landing Approach
#23	San Diego (SAN)	San Francisco (SFO)	B737	Night - Instrument Landing Approach
#24	Boston (BOS)	New York (JFK)	B737	Night - Visual Landing Approach
#25	San Francisco (SFO)	Seattle (SEA)	B767	Night - Instrument Landing Approach
#26	Chicago (ORD)	Minneapolis (MSP)	B767	Day - Visual Landing Approach
#27	Minneapolis (MSP)	St. Louis (STL)	B767	Day - Instrument Landing Approach
#28	St. Louis (STL)	Chicago (ORD)	B737	Night - Visual Landing Approach
#29	Kansas City (MCI)	Salt Lake City (SLC)	B737	Day - Visual Landing Approach
#30	Seattle (SEA)	Minneapolis (MSP)	B747	Day - Visual Landing Approach
#31	Minneapolis (MSP)	Chicago (ORD)	B737	Night - Instrument Landing Approach
#32	Washington (IAD)	New York (JFK)	B737	Day - Visual Landing Approach
#33	New York (JFK)	Cleveland (CLE)	B767	Night - Instrument Landing Approach
#34	Cleveland (CLE)	Chicago (ORD)	B767	Day - Visual Landing Approach
#35	New Orleans (MSY)	Washington (IAD)	B737	Night - Instrument Landing Approach
#36	Washington (IAD)	New Orleans (MSY)	B747	Day - Visual Landing Approach
#37	Dallas (DFW)	Kansas City (MCI)	B737	Night - Instrument Landing Approach
#38	New York (JFK)	Miami (MIA)	B747	Day - Visual Landing Approach
#39	Miami (MIA)	Tampa (TPA)	B737	Day - Instrument Landing Approach
#40	Tampa (TPA)	Atlanta (ATL)	B767	Night - Instrument Landing Approach
#41	Boston (BOS)	Philadelphia (PHL)	B767	Day - Visual Landing Approach
#42	Atlanta (ATL)	St. Louis (STL)	B737	Day - Instrument Landing Approach

Career Flight Assignment Airports & Aircraft (cont.)

Assignment	Departure	Destination	Aircraft	Conditions
#43	St. Louis (STL)	Chicago (ORD)	B737	Day - Instrument Landing Approach
#44	Denver (DEN)	New York (JFK)	B747	Day - Visual Landing Approach
#45	San Diego (SAN)	Denver (DEN)	B767	Day - Visual Landing Approach
#46	Denver (DEN)	San Diego (SAN)	B737	Night - Instrument Landing Approach
#47	Boston (BOS)	St. Louis (STL)	B767	Day - Visual Landing Approach
#48	St. Louis (STL)	Kansas City (MCI)	B767	Day - Instrument Landing Approach
#49	St. Louis (STL)	Boston (BOS)	B737	Night - Visual Landing Approach
#50	Los Angeles (LAX)	Seattle (SEA)	B747	Day - Visual Landing Approach
#51	Seattle (SEA)	San Francisco (SFO)	B737	Day - Visual Landing Approach
#52	San Francisco (SFO)	Albuquerque (ABQ)	B737	Night - Instrument Landing Approach
#53	San Francisco (SFO)	Denver (DEN)	B767	Day - Visual Landing Approach
#54	Denver (DEN)	St. Louis (STL)	B737	Day - Instrument Landing Approach
#55	Cleveland (CLE)	Detroit (DTW)	B737	Day/Night - Visual Landing Approach
#56	Houston (IAH)	Los Angeles (LAX)	B747	Night - Instrument Landing Approach
#57	Denver (DEN)	Salt Lake City (SLC)	B737	Day/Night - Visual Landing Approach
#58	Chicago (ORD)	Detroit (DTW)	B737	Day - Visual Landing Approach
#59	Detroit (DTW)	Washington (IAD)	B767	Day - Instrument Landing Approach
#60	Washington (IAD)	New York (JFK)	B737	Night - Visual Landing Approach
#61	New Orleans (MSY)	Dallas (DFW)	B737	Day - Instrument Landing Approach
#62	San Diego (SAN)	Houston (IAH)	B747	Day - Visual Landing Approach
#63	Houston (IAH)	New Orleans (MSY)	B737	Night - Instrument Landing Approach
#64	Chicago (ORD)	Philadelphia (PHL)	B737	Day - Instrument Landing Approach
#65	Philadelphia (PHL)	Boston (BOS)	B767	Day/Night - Visual Landing Approach
#66	St. Louis (STL)	Dallas (DFW)	B767	Day - Instrument Landing Approach
#67	Dallas (DFW)	Chicago (ORD)	B737	Night - Visual Landing Approach
#68	Washington (IAD)	Minneapolis (MSP)	B747	Day - Visual Landing Approach
#69	Minneapolis (MSP)	New York (JFK)	B747	Day - Visual Landing Approach
#70	Salt Lake City (SLC)	San Francisco (SFO)	B737	Night - Instrument Landing Approach
#71	San Francisco (SFO)	San Diego (SAN)	B737	Day - Visual Landing Approach
#72	San Diego (SAN)	Kansas City (MCI)	B737	Night - Instrument Landing Approach
#73	Boston (BOS)	Minneapolis (MSP)	B767	Day - Visual Landing Approach
#74	New Orleans (MSY)	Chicago (ORD)	B767	Night - Instrument Landing Approach
#75	Albuquerque (ABQ)	Los Angeles (LAX)	B737	Night - Visual Landing Approach
#76	Atlanta (ATL)	Washington (IAD)	B747	Day - Instrument Landing Approach
#77	Tampa (TPA)	Philadelphia (PHL)	B747	Day - Visual Landing Approach
#78	St. Louis (STL)	Seattle (SEA)	B747	Night - Instrument Landing Approach
#79	San Diego (SAN)	Phoenix (PHX)	B737	Night - Visual Landing Approach
#80	St. Louis (STL)	New York (JFK)	B767	Night - Instrument Landing Approach
#81	Houston (IAH)	Washington (IAD)	B747	Day - Visual Landing Approach
#82	Denver (DEN)	Seattle (SEA)	B737	Day - Instrument Landing Approach
#83	Houston (IAH)	Phoenix (PHX)	B767	Night - Visual Landing Approach
#84	San Francisco (SFO)	Chicago (ORD)	B747	Night - Instrument Landing Approach

Career Flight Assignment Airports & Aircraft (cont.)

Assignment	Departure	Destination	Aircraft	Conditions
#85	Phoenix (PHX)	Los Angeles (LAX)	B737	Day - Visual Landing Approach
#86	St. Louis (STL)	Detroit (DTW)	B737	Day - Instrument Landing Approach
#87	Detroit (DTW)	Minneapolis (MSP)	B747	Day/Night - Visual Landing Approach
#88	Miami (MIA)	Pittsburgh (PIT)	B747	Night - Visual Landing Approach
#89	Seattle (SEA)	Albuquerque (ABQ)	B767	Day - Instrument Landing Approach
#90	Philadelphia (PHL)	New Orleans (MSY)	B767	Day - Visual Landing Approach
#91	Seattle (SEA)	Salt Lake City (SLC)	B767	Night - Visual Landing Approach
#92	Denver (DEN)	Los Angeles (LAX)	B737	Night - Instrument Landing Approach
#93	Cleveland (CLE)	Tampa (TPA)	B767	Day - Visual Landing Approach
#94	Los Angeles (LAX)	Chicago (ORD)	B747	Day - Instrument Landing Approach
#95	Minneapolis (MSP)	Cleveland (CLE)	B737	Day/Night - Visual Landing Approach
#96	Minneapolis (MSP)	St. Louis (STL)	B747	Night - Instrument Landing Approach

18 SubLOGIC Airlines Aircraft Specifications

As you progress through the career flight assignments, you will have many opportunities to fly the Boeing 737, Boeing 767, and Boeing 747 aircraft. The Airbus A320 and Shorts 360 serve special purposes, and are available in free flight mode. A brief operational description of each aircraft may help you understand the differences in aircraft "feel" you will experience in the ATP simulation.

Boeing 737

The spritely Boeing 737 (see Figures 18.1 and 18.2) has low mass, a good power-to-weight ratio, and the quickest control response. This aircraft will probably be your first choice for general-purpose flights. Indeed, the B737 pilots we've spoken to find this aircraft a real pleasure to fly and, when told that our customers would be learning to fly on it, expressed the opinion that if a transport aircraft was to be used to introduce people to aviation the Boeing 737 was the ideal choice.

The Boeing 737, a design of the mid-1960s, uses a variation of the Pratt & Whitney JT8D, an engine of proven record on B727s and DC9s. While not as fuel-efficient as many modern powerplants, the JT8D's installation in the B737 delivers the type of utility which should give it a very long service life.

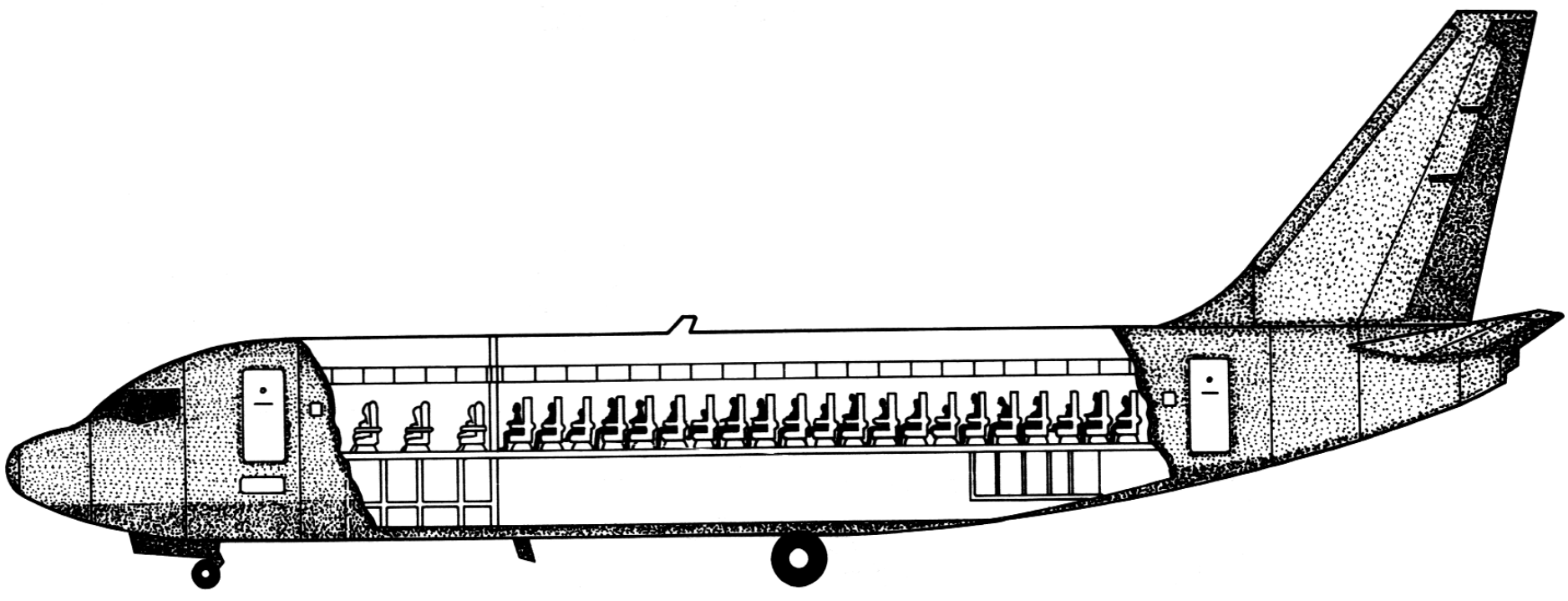


Figure 18.1. Boeing 737 Cutaway View

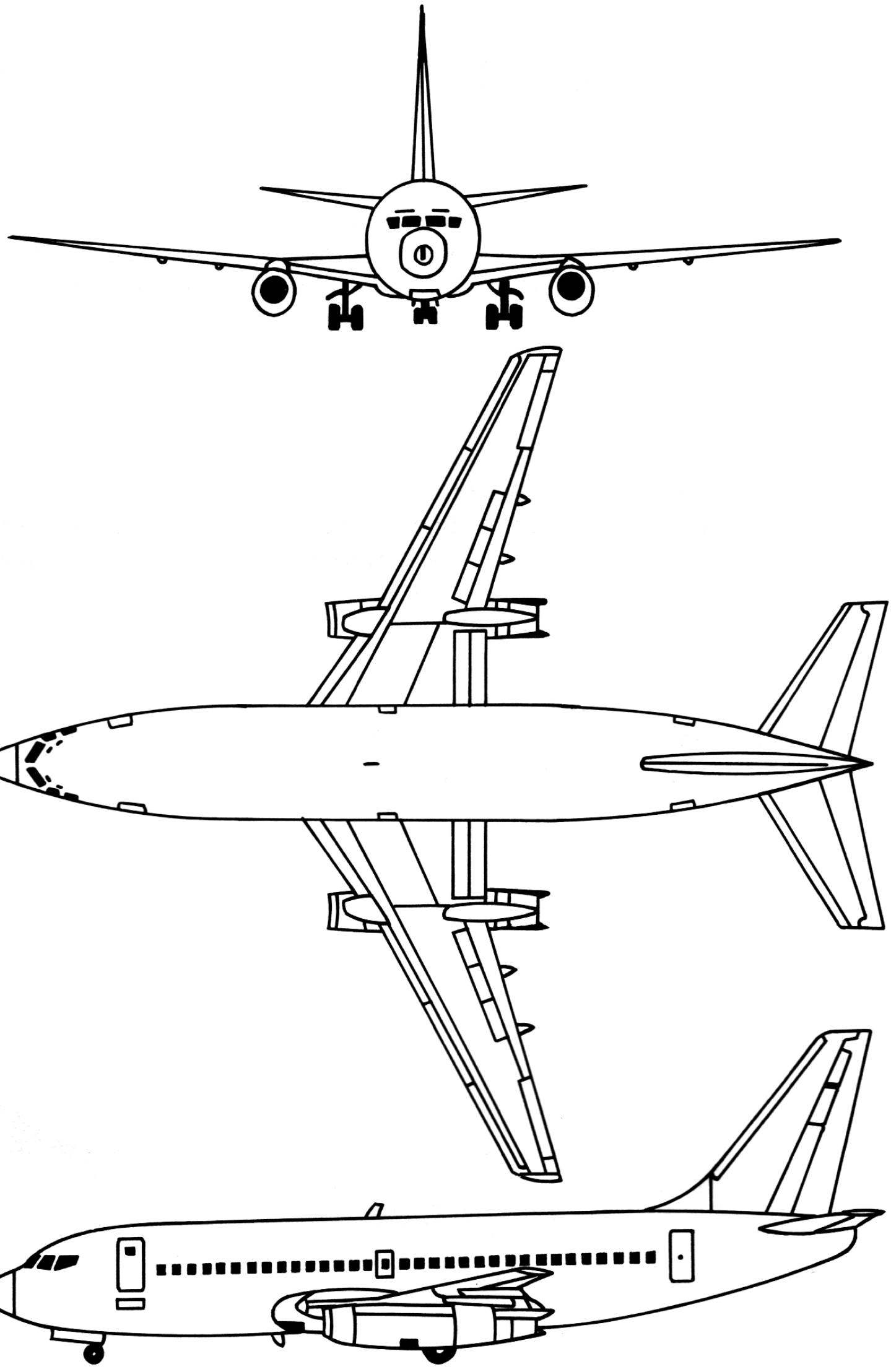


Figure 18.2. Boeing 737 Three-Way View

Airbus A320

The Airbus A320 (see Figures 18.3 and 18.4), a cooperative development of several European aircraft companies, is clearly a product of the 1980s. A modern EFIS (electronic flight instrument system) is an obvious distinguishing characteristic, but the most unique aspect of this aircraft as simulated in Flight Assignment: A.T.P. is its "fly by wire" flight control system. While in reality a stably loaded aircraft's pitching moments are present any time the elevator, ailerons, power, flaps, gear, etc. are changed, the A320's control system senses and automatically compensates for these changes.

If you are having trouble mastering the physics of aircraft control and want to fly an aircraft across the ATP United States scenery anyway, *the Airbus A320 is included in this simulation as an easy flight mode aircraft.* While the simulation of this aircraft in Flight Assignment: A.T.P. is somewhat simplified (especially in terms of aircraft control in turns and short final approach), the following control methods are used:

The use of pitch control directly changes pitch attitude. Pitch attitude remains constant when elevator control is released, and remains constant even as the aircraft configuration is changed. There are limits to the flight computer's ability to give the pitch attitude you desire. The flight computer will not allow the aircraft to stall, and will lower the nose or reduce bank before this happens.

The flight computer, by making flight control so easy and trouble-free, ensures that the A320 will not be the aircraft of choice for computer airliner hot-rodders. (Oh well, airline pilots aren't supposed to hot-rod anyway.) Roll rate is limited and, except when needed to keep the aircraft from stalling, the A320's computer will not allow the aircraft to exceed 30 degrees nose up pitch, 15 degrees nose down pitch, and a maximum allowable bank angle of 67 degrees.

Beyond the A320's electronic gimmickry, its performance is notable. It has great short-field performance yet is extremely efficient. Note the high altitude cruise power settings for both the B737 and the A320 in the ATP Quick Reference Handbook. The same fuel flow carries many more passengers. The wing of the A320 appears to be perfected for this one cruise mode and, in other operations, higher fuel flows commensurate with its higher weight are used.

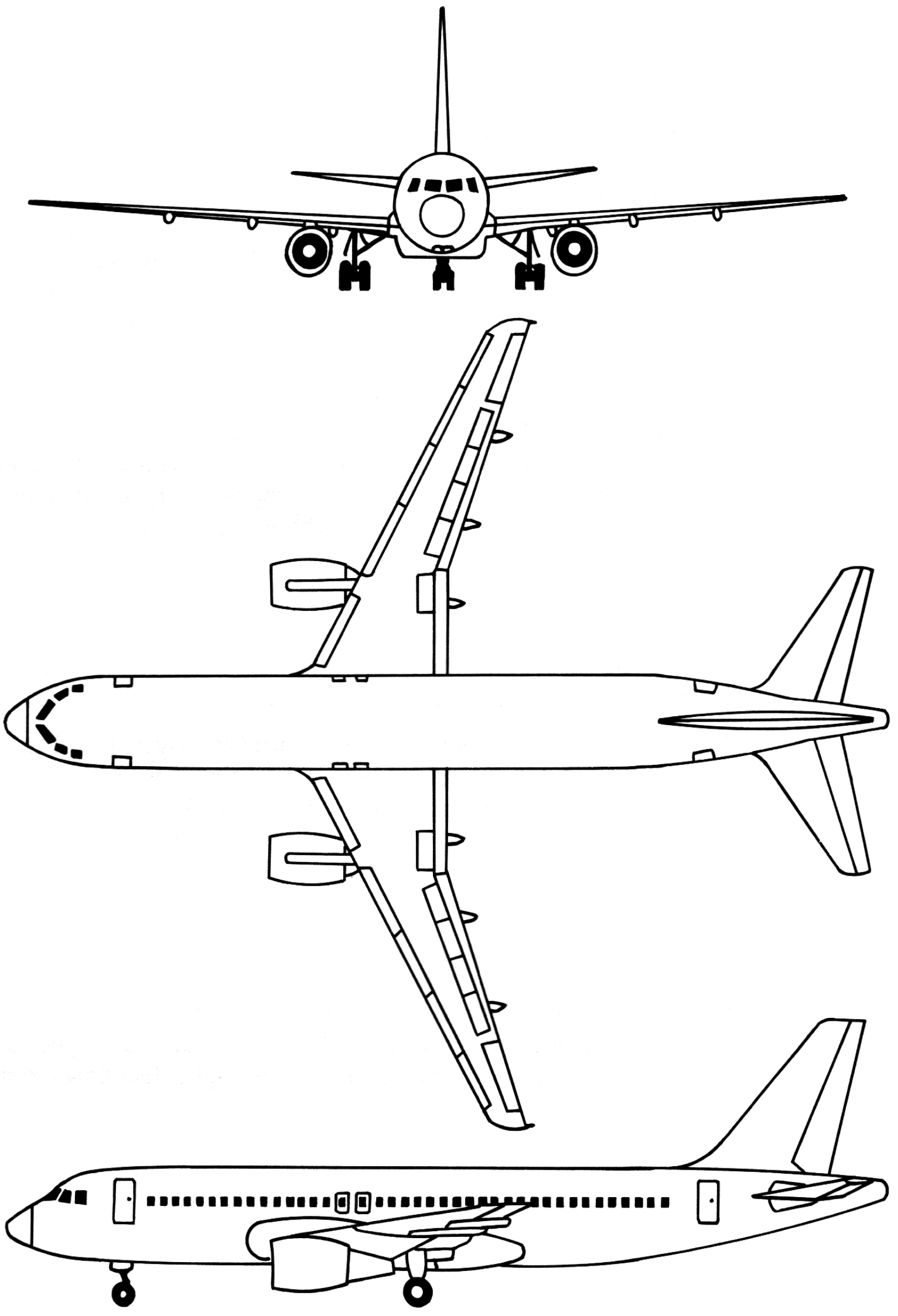


Figure 18.3. Airbus A320 Three-Way View

Boeing 767

Just as the A320 symbolizes the modern era for smaller transports in Flight Assignment: A.T.P., the Boeing 767 (see Figures 18.5 and 18.6) extends the meaning to larger transports. The B767, introduced in the early 1980s, also relies heavily on EFIS and computer flight management. Gone is that spritely takeoff performance that you'll find in the B737 and A320. It's not that the extra power isn't available, but that the power is managed for economy instead of performance. You'll get all the power you need to takeoff this 300,000 lb. machine and, when you reduce to climb power, you'll notice that the reduction is not as drastic as it is in the B737.

Your takeoff distance will be noticeably longer. After rotation, positive climb and gear retraction, you will have to lower the nose just the amount needed to allow a gradual acceleration to flap retraction speeds. Never lower the nose to the point where you won't maintain at least a 500 FPM rate of climb (you should be able to maintain 1000 FPM during post-takeoff acceleration). This flap retraction/aircraft acceleration exercise will take time, especially at high weights. You'll finish the acceleration to 250 kts before you reduce to climb power. In this aircraft (and also in a loaded B747) you'll probably end up at 3000 feet before power reduction. Actually, lower altitude power reductions are not recommended for any large transport aircraft. Early B737 power reductions are performed in the ATP simulation to avoid high pitch attitudes, which make it difficult for you to see the ground. Real B737 operations avoid power reductions until up to 3000 feet.

Note the variety of climbout pitch attitudes given in the QRH. Select what you feel would be the most efficient pitch/power combinations during climb. Choose your cruise altitude carefully. If you're heavy, you'll waste more fuel getting up to those "efficient" higher flight levels than they will save you. If you're lightly loaded or have burnt off fuel in flight, head up to FL390 or even FL410 for an efficient mach .82 flight in the low-drag thin air.

Power control for the B767 is noted in terms of N_1 RPM as well as fuel flow. This is the speed of the hi-bypass engine fan. The hot jet exhaust air turns the turbine connected to the N_1 shaft but, rather than compressing air for entry into the jet engine, the big fan in the front of the engine (connected to the N_1 shaft) is more like a conventional propeller in purpose. Since force is a function of the square of velocity, most changes in thrust occur in the upper ranges of N_1.

Descents and approaches in the B767 are conventional, but note the higher fuel flows on final approach. Don't let the aircraft get low and slow or you may need a lot of power to get back to glidepath.

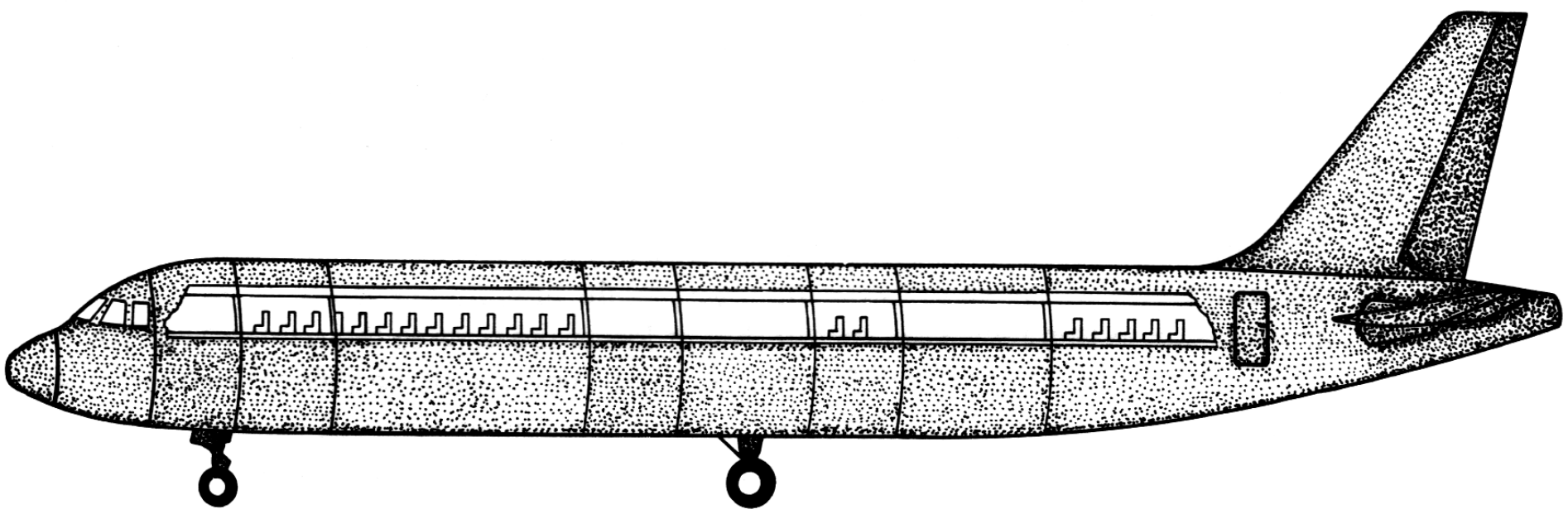


Figure 18.4. Airbus A320 Cutaway View

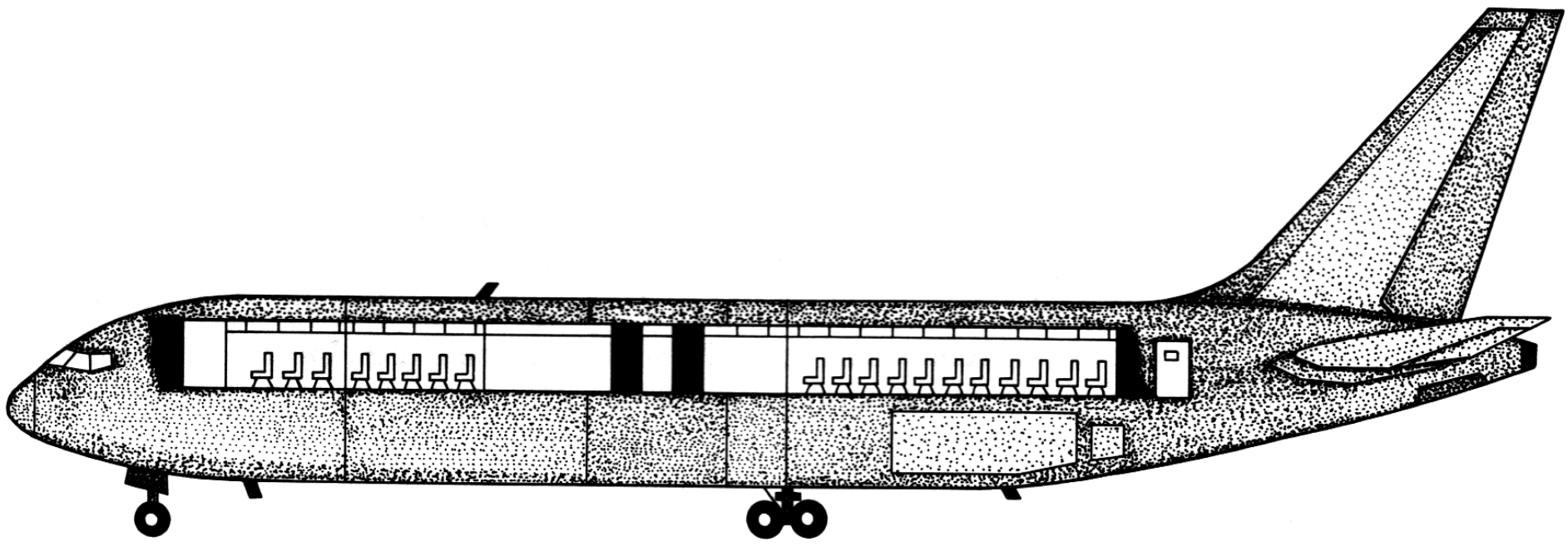


Figure 18.5. Boeing 767 Cutaway View

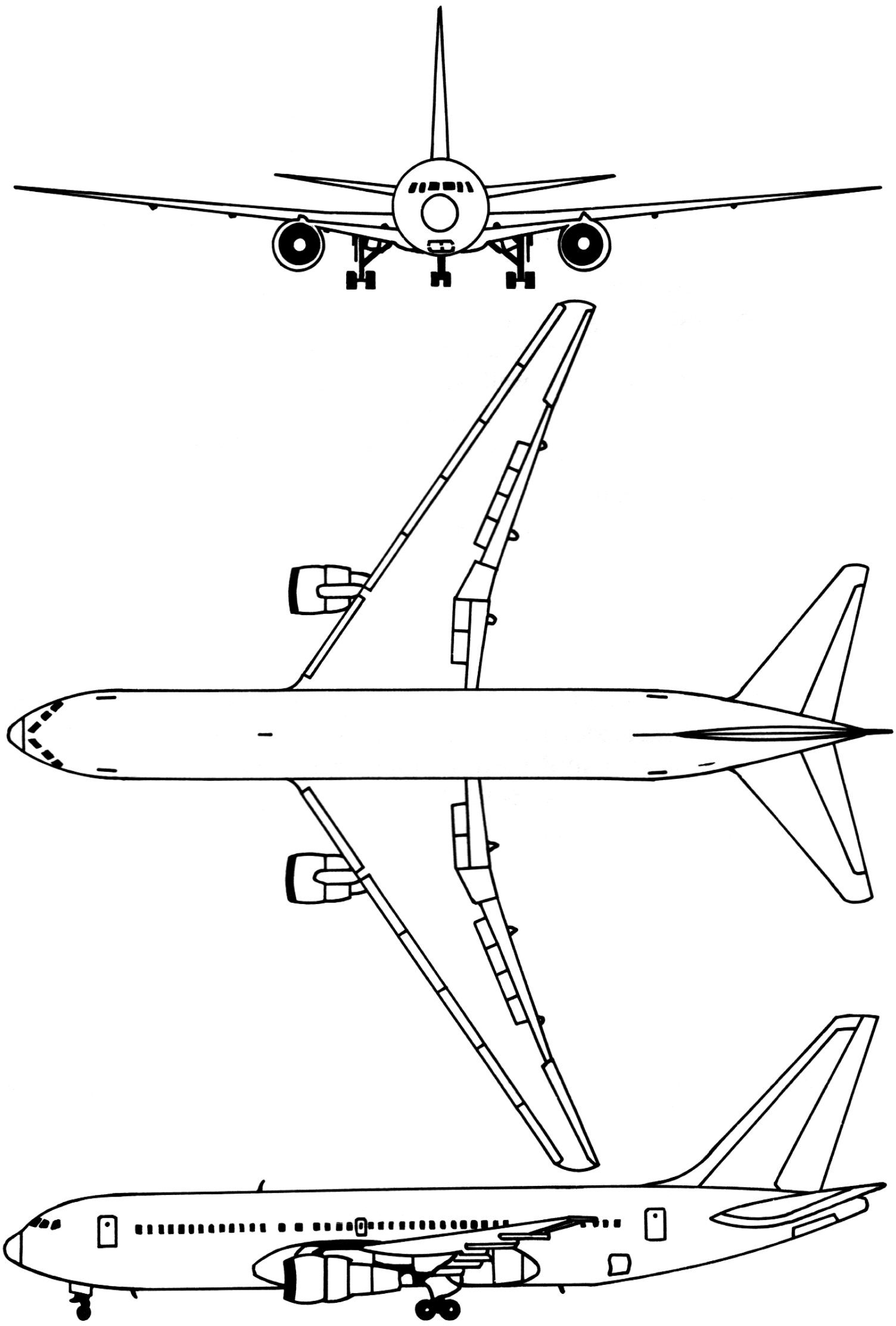


Figure 18.6. Boeing 767 Three-Way View

Boeing 747

A design of the late 1960s, the mighty Boeing 747 (see Figures 18.7, 18.8 and 18.9) fills a purpose for which few aircraft manufacturers wish to compete. Look closely at the B747 specifications in Table 18.1 at the end of this chapter. The Boeing 747 is a "whale" of an aircraft, and the ATP simulation will give you the feel of moving up in size to this 800,000-lb machine. You will even experience a large variance in flight characteristics of the B747 itself at 525,000 lbs (below maximum landing weight) as opposed to fully loaded at 800,000 lbs (maximum takeoff weight). (In reality you would seldom need to takeoff at weights in excess of 700,000 lbs). This variance in takeoff vs. landing weight is well illustrated by the takeoff speed tables in the QRH. Wing loading in terms of pounds per square foot of wing area is so high in a loaded B747 that rotation speeds approach 160 kts. You'll note a long takeoff run in your B747.

The climbout in the B747 requires even more care than the B767. The aircraft may take quite a while to climb (it's a good thing ATP offers a time acceleration feature), and for its cross-country role you may opt to request level-off at FL310 or FL330 at .84M until you burn off fuel. Those four engines will "guzzle" as much as 24,000 lbs of fuel per hour in heavy cruise flight. At lighter aircraft weights, climb up to FL410 and cruise at .87M.

Note the 565,000 lb maximum landing weight listed in Table 18.1. Some of the flight assignment modes may require you to land with excess fuel on board. Don't worry, you've been granted a waver for high-weight landings. At lighter loads, note the rather normal approach speeds for the B747. Landing distances will be much shorter than your heavy-takeoff distance requirements.

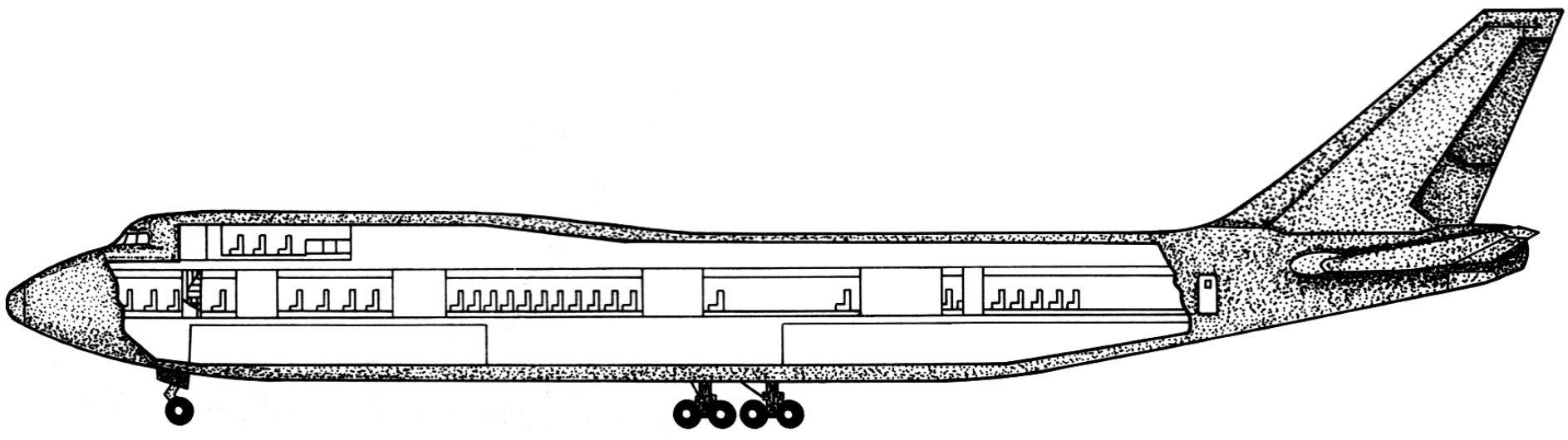


Figure 18.7. Boeing 747 Cutaway View

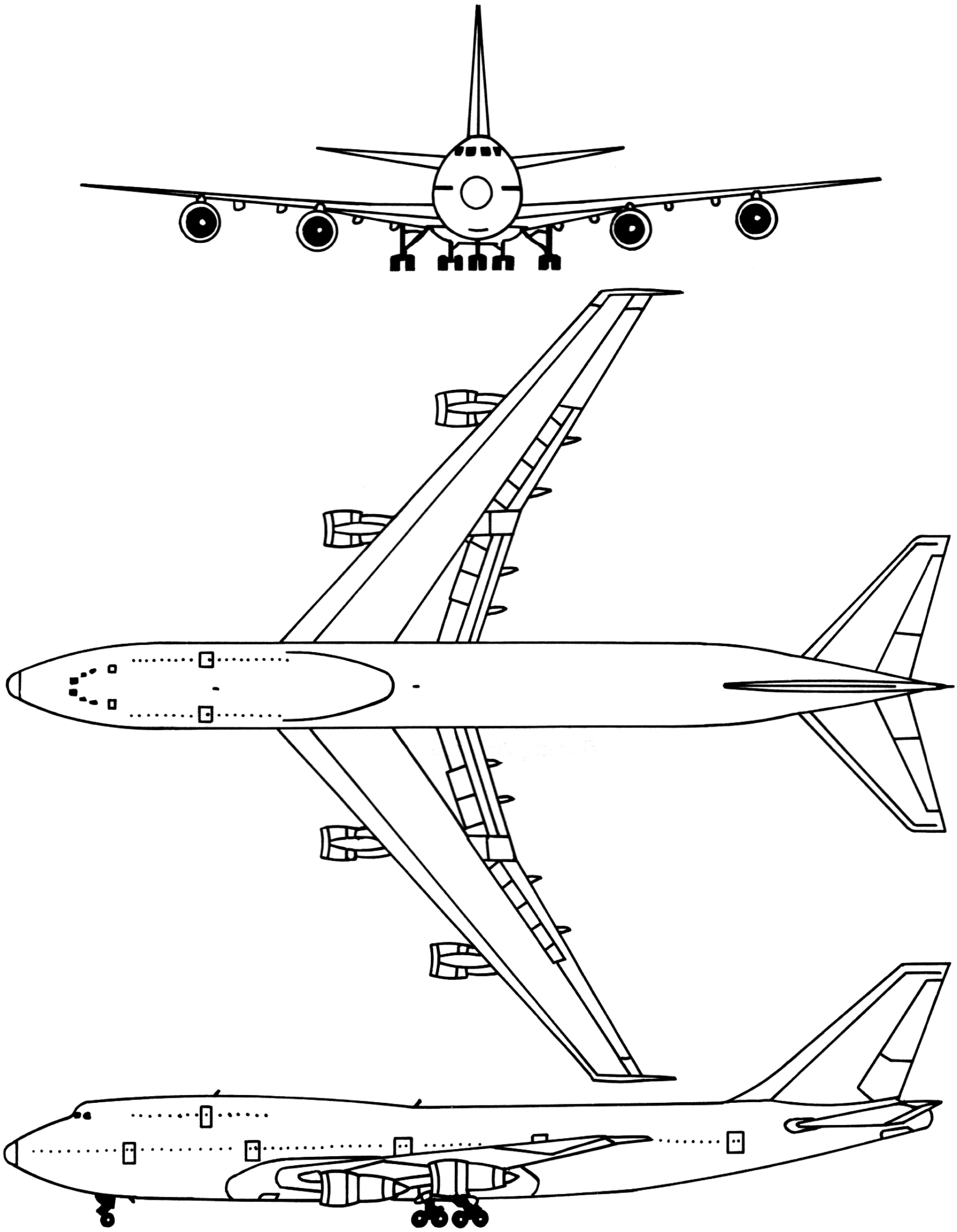


Figure 18.8. Boeing 747 Three-Way View

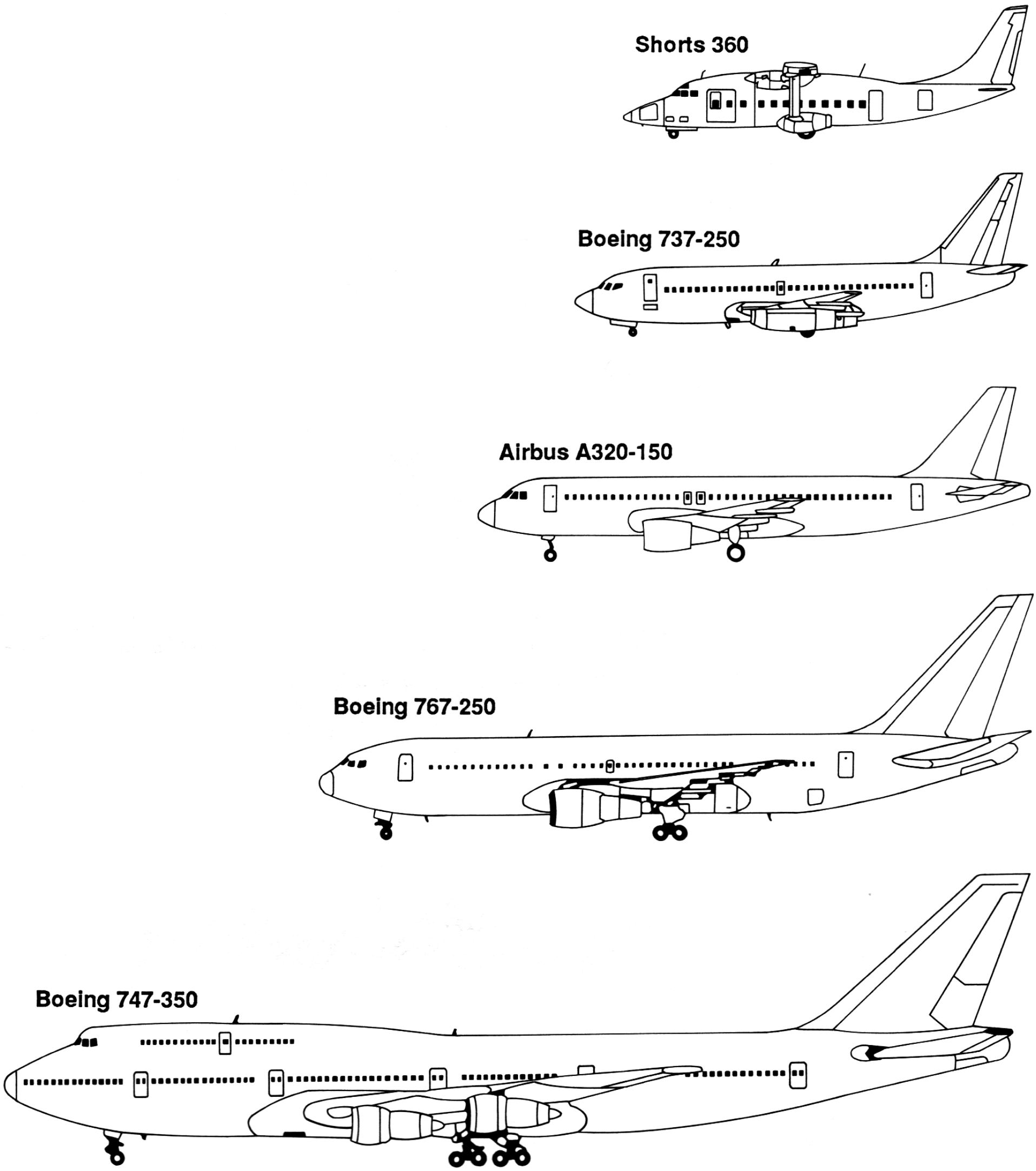


Figure 18.9. Aircraft Relative Size Comparison (Scale 1:480)

Shorts 360

The Shorts 360 twin-engine turboprop aircraft (see Figures 18.10 and 18.11) is included in the simulation even though it is outside the scope of ATP. This aircraft's primary purpose is to help you make connections to the smaller airports on optional SubLOGIC Scenery Disks. As such, it is modeled for extremely easy operation and unrealistic short field performance. The SubLOGIC Airlines Shorts 360 is modified with special flaps and slats for STOL (short takeoff and landing) operations. The special flaps settings are located on the flaps position indicator on the instrument panel. One setting is located above the zero flaps indication (STO, for short takeoff), and another setting is below the 30° down flaps indication (LDG, for short landing). These extra settings are accessed in the usual way by pressing the keypad [+] and [-] keys. The Shorts 360 is also equipped with IRS to help you locate the smallest landing strip on any Scenery Disk. Note that the Shorts 360 does not have a secondary instrument panel; all necessary engine monitoring instruments and autopilot indicators are located on the primary instrument panel. The Shorts 360 is not equipped with a color weather radar display.

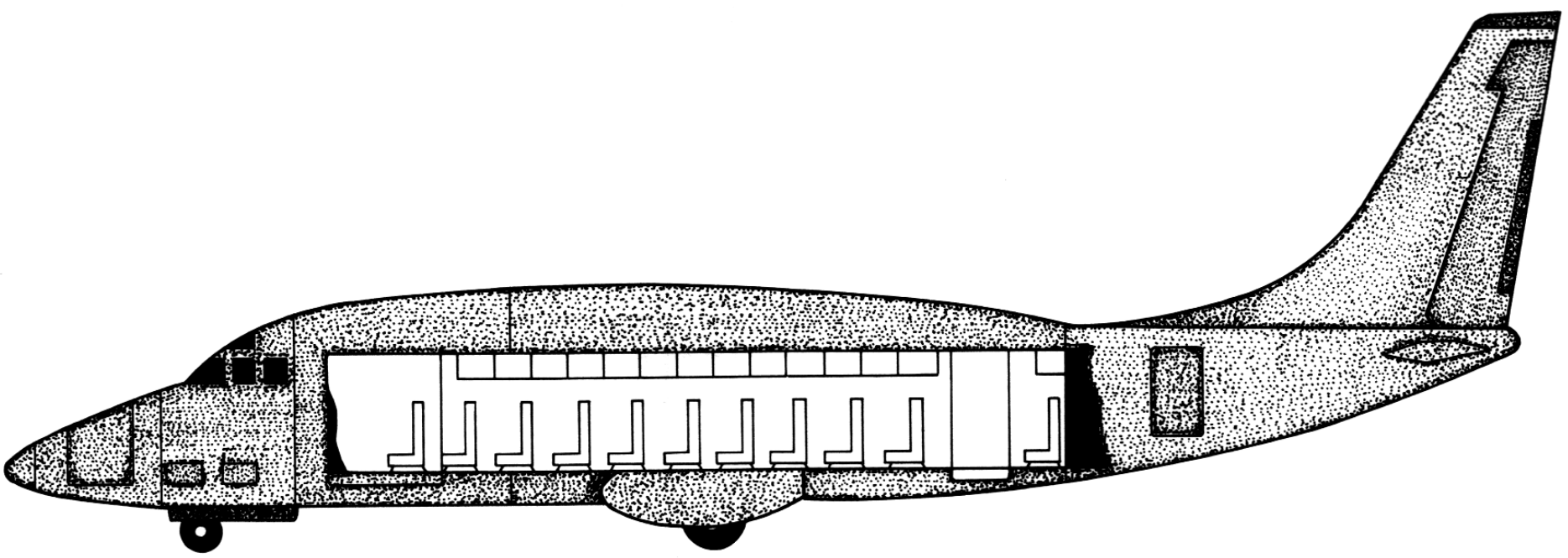


Figure 18.10. Shorts 360 Cutaway View

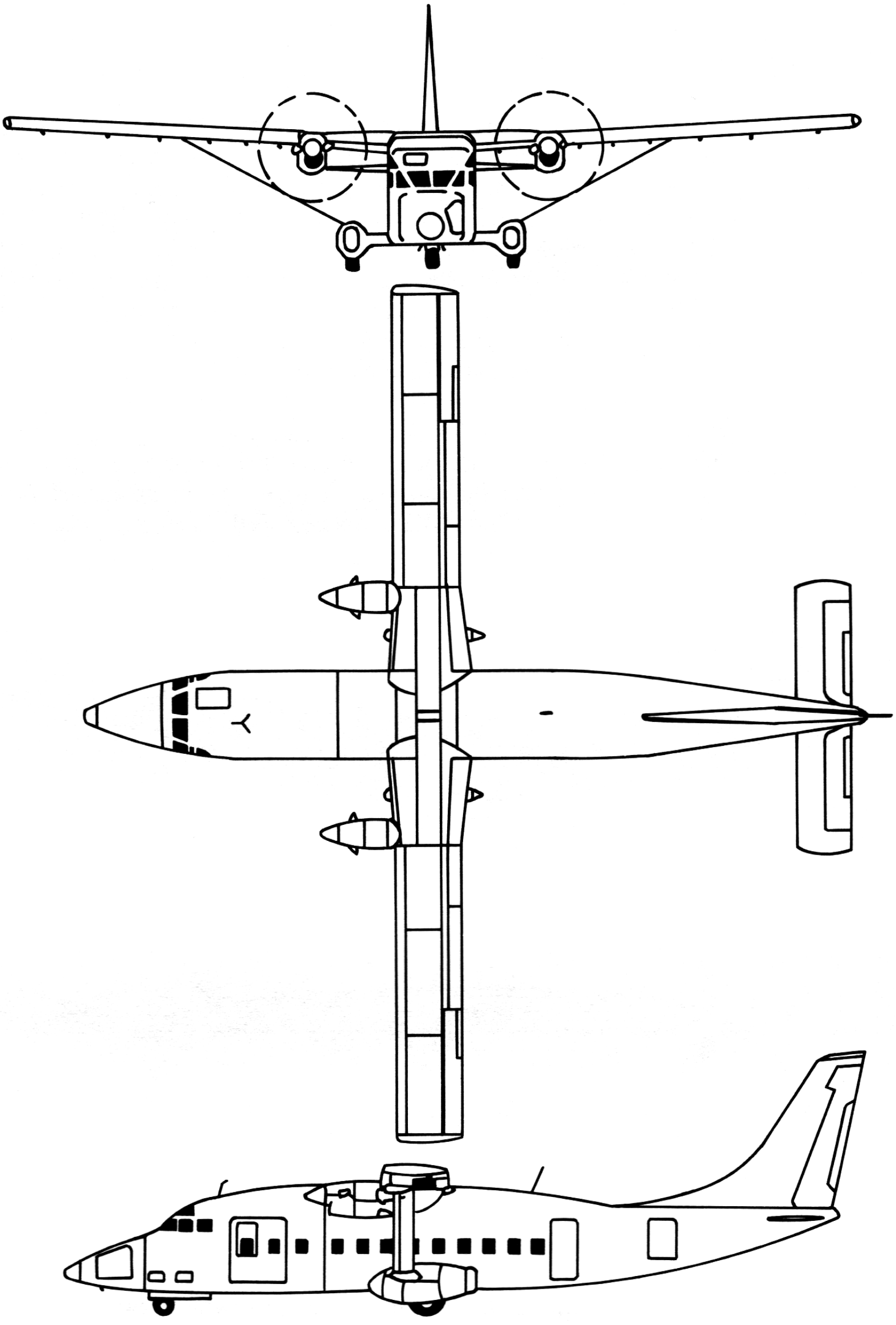


Figure 18.11. Shorts 360 Three-Way View

Table 18.1. SubLOGIC Airlines Aircraft Specifications

	Boeing 737-250	Airbus A320-150	Boeing 767-250	Boeing 747-350
Powerplant				
Type	Pratt & Whitney JT8D	CFM 56	GE CF6	Pratt & Whitney JT9D
Thrust Rating	14,500 lbs	24,000 lbs	48,000 lbs	54,000 lbs
Performance				
Max Operating Speed	.8 Mach	.82 Mach	.86 Mach	.92 Mach
Max Cruise Speed	.78 Mach	.78 Mach	.82 Mach	.87 Mach
Average Takeoff Distance	6,000 feet	5,600 feet	5,700 feet	10,500 feet
Average Landing Distance	4,500 feet	4,800 feet	4,800 feet	7,000 feet
Range (nautical miles)	2,400 NM	2,600 NM	3,000 NM	6,500 NM
Maximum Altitude	37,000 feet	39,000 feet	43,000 feet	45,000 feet
Physical Properties				
Wingspan	97 feet	112 feet	156 feet	196 feet
Length	100 feet	123 feet	155 feet	232 feet
Height	37 feet	39 feet	52 feet	63 feet
Empty Weight	60,000 lbs	85,000 lbs	180,000 lbs	380,000 lbs
Max Takeoff Weight	115,000 lbs	158,000 lbs	300,000 lbs	800,000 lbs
Max Landing Weight	105,000 lbs	138,000 lbs	270,000 lbs	565,000 lbs
Weight of Full Fuel	30,000 lbs	41,000 lbs	112,000 lbs	350,000 lbs
Payload (passengers & cargo)	25,000 lbs	40,000 lbs	70,000 lbs	150,000 lbs
Passenger Seats	115	160	220	420

19 Exploring Scenery Disks and Scenery Files

Flight Assignment: A.T.P. is compatible with all SubLOGIC Scenery Disks. You can either insert Scenery Disks into drive A and log them in one by one as you fly, or convert them into DOS scenery files on your hard disk drive and let the ATP program automatically load the appropriate scenery file for the area of the country in which you are flying. (See the "Scenery Library Options" section of Chapter 15 for a description of how to load Scenery Disks from drive A.) This chapter describes how to convert Scenery Disks to DOS-compatible scenery files, and how to use converted scenery files with ATP. A detailed description of past and presently available SubLOGIC Scenery Disks is also provided.

Converting a Scenery Disk to a Scenery File

Scenery loading is much faster and more convenient if you convert the Scenery Disk data to a scenery file and copy this file onto your hard disk drive. Log onto the hard drive subdirectory you created for the ATP program and, from the DOS prompt, run the CONVERTS.EXE program located in the ATP subdirectory by typing CONVERTS followed by [Enter]. Follow the program prompts to convert the Scenery Disk to a scenery file and load it onto the hard disk drive. The scenery file you create will be named SD-X.SCN, with X identifying the Scenery Disk from which the file was created.

Using Scenery Files with Flight Assignment: A.T.P.

Load and run the ATP program as usual from the hard disk drive. Press [F7] to select the Flight Planning menu, then select option 1, Scenery Library, to turn on the scenery library sub-menu. This menu lists all of the converted scenery files located on the hard disk (in the ATP subdirectory). Use option B, More Available Scenery Files, if necessary to find the scenery file you would like to load. Select the scenery file, follow the program prompts to load it, then press [space bar] to return to normal flight mode.

The new scenery is now available, but you must move yourself to a location within the scenery file boundaries to view it. Press [F7] again to re-select the Flight Planning menu, and use option 3, Position Using N/E, to enter the North and East coordinates of an airport located in the new scenery area. Available airports and their North and East coordinate locations are listed on the sectional maps included with the Scenery Disk. Set altitude to 0 and you will be placed at the airport field elevation. Press [space bar] to return to flight mode, and you should find yourself at the airport you've selected.

When you have multiple scenery files located in the ATP subdirectory on your hard disk drive, the ATP program can automatically select and load different scenery files as you fly or slew from one scenery area to another. Select scenery library sub-menu option A, Auto Scenery Selection, to toggle the automatic scenery loading option on and off. A + symbol indicates that the automatic scenery selection option is turned on.

Scenery Evolution and Development

For years SubLOGIC has been developing Scenery Disks for use with Microsoft® Flight Simulator® and SubLOGIC's own flight simulation programs in order to expand the potential flying environment for the user. With each new Scenery Disk a higher level of detail and sophistication was reached, but there were always inherent limitations in the Flight Simulator® technology. ATP provided the perfect opportunity for us to develop a new style of more sophisticated scenery. New scenery constructs and primitives were designed that allowed more flexibility and accuracy than ever before. We were dedicated to providing the user with an environment that made flying these big rigs (the heavies) as exciting as possible. ATP has the most complete and advanced scenery available in any PC-based aircraft simulation, covering the entire continental United States with more accurate radio nav-aid stations than anything we've offered before. ATP's new visuals are more complete as well, with over 1000 buildings, over 500 transmitter towers, and over 350 airports with complete markings and lighting.

Even with all of our sophisticated scenery development technology, we just can't cover such a large area in uniformly great detail. This is why Scenery Disks will continue to be valuable to "armchair" pilots, providing them with more airports, nav-aids, and visual details.

ATP provides a unique way to tour your scenery library by allowing you to fly farther than ever before. You won't need to make extra copies of your existing scenery files since ATP now allows you to specify a directory path to your scenery. You can also see all of your scenery files listed on the scenery library sub-menu to select the exact area you want, or use automatic scenery loading.

The ATP simulation includes all public-access airports with at least one runway 7000 feet or greater in length, so many smaller airports have been left off. Since the Shorts 360 can service smaller airports, you will find a new challenge in landing the Shorts 360 on the shorter runways found on Scenery Disks.

Here is a brief look at Scenery Disks and what makes each one special:

Scenery Disks 1-6

These earliest Scenery Disks were developed in a relatively short period of time, before we knew what the demand for Scenery Disks would be. The scenery department consisted of one designer with limited resources designing for the Commodore 64 computer. One interesting fact about these early Scenery Disks is that all runways are twice as wide and long as they should be.

While crude by current standards, Scenery Disks 1-6 still offer some interesting features. All contain numerous airports and nav-aids. NDBs are depicted on the area charts since the same charts are used for all computer versions of the Scenery Disks. The IBM-compatible Microsoft® Flight Simulator® program didn't support NDBs in those days, so IBM Scenery Disks didn't contain any code for them.

Scenery Disk #1 lets you tour most of Texas, the state with the most public-access airports in the United States.

Scenery Disk #2 includes Albuquerque, surrounded by the Sandias and Manzanos Mountains.

Scenery Disk #3 provides a wide variety of airports and nav-aids located on the Los Angeles, Las Vegas, and San Francisco Aeronautical Sectional area charts.

Scenery Disk #4 features a dramatic rendition of Crater Lake on top of Mt. Scott in Oregon.

Scenery Disk #5 is perhaps the most visually appealing of these early Scenery Disks. Denver is located at the edge of the Rocky Mountains, and you can follow I-70 into the mountains or fly from Cheyenne to Salt Lake City and land along the Great Salt Lake.

Scenery Disk #6 covers a huge portion of the midwest with dozens of airports, nav-aids, highways, rivers and lakes.

San Francisco STAR Scenery Disk

Dissatisfaction with the first set of Scenery Disks led us to develop a high-density scenery area that is now included as part of the standard scenery on Microsoft® Flight Simulator®. This was the first Scenery Disk to include ILS approaches.

Japan Scenery Disk

Originally developed for the Japanese market and destined for the NEC-9801F computer, this disk covers most of Honshu Island. It is the second Scenery Disk released with ILSs, and also features number designators at the ends of runways.

Scenery Disk #7

A graphic artist was hired as the second member of the scenery department halfway through this project. His contribution shows in this visually stunning Scenery Disk that has become a must for every flight simulation fanatic's library. It includes detailed representations of Washington DC, a space shuttle on the launch pad at Cape Kennedy, Miami, Jacksonville, and Tampa. This Scenery Disk also allows some island-hopping in the Bahamas. Scenery Disk #7 is definitely a favorite of the SubLOGIC scenery department. Several ILSs and detailed airports highlight the aviation portion of this disk.

Scenery Disk #11

Building upon the techniques developed in previous Scenery Disks, this disk includes detailed renditions of Pittsburgh, Detroit, and Niagara Falls. You can fly below the rim of the Niagara River gorge and under Rainbow Bridge. ILS approaches had become a standard component of Scenery Disks by this time, as had runway markings.

"Western European Tour" Scenery Disk

Another international Scenery Disk, this time covering large portions of France, Great Britain, and Germany. You can see the Eiffel Tower in a way that few others have. There is a wonderfully detailed rendition of London, with the Tower Bridge, Parliament, and Buckingham Palace.

Scenery Disk #9

Developed during and immediately after the development of Microsoft® Flight Simulator® Version 3. VASI lights, runway markings to FAA specifications, and more complete attention to instrument navigation set this disk apart from previous Scenery Disks. There are detailed renditions of Chicago, St. Louis (complete with Gateway Arch), Indianapolis and Cincinnati, packing the disk so full of data that no more could be included at this level of technology. New technologies had to be developed so we could deliver still more scenery.

"Hawaiian Odyssey" Scenery Adventure

Not just "another pretty disk", this is a Scenery Disk of incredible visual impact, with mountains and volcanoes jutting up from the Pacific Ocean. The designers decided to include a few scenery programming tricks as well. Where else can you fly where up is not really up? Or shrink down and fly through a kitchen where a common housefly dwarfs your aircraft? This disk is full of beautiful scenery and unusual challenges, including an interactive treasure hunt for the hidden jewel of the goddess Pele.

Scenery Disk #12

Scenery Disk #12 incorporates the very latest ATP scenery technologies, and covers the New York, Montreal and Halifax sectional areas in incredible detail. This disk provides the most advanced and spectacular scenery available on any Scenery Disk to date.

Instrument Pilot's Scenery

This is a must for the serious instrument pilot. Two Instrument Pilot's Scenery sets (East U.S. and West U.S.) contain EVERY paved public-access airport, EVERY civilian nav-aid, and almost every ILS located in the continental United States. Instrument Pilot's Scenery (IPS) sets finally give you that favorite local airport and all supporting navigation radio facilities. With IPS visual scenery limited to runways, you get the highest possible screen refresh rate. When incorporated into the default ATP scenery database, you get not only the standard ATP visuals but also every single U.S. public airport, with complete runway markings, lighting, VASIs and displaced thresholds. You also get complete instrument nav-aids, including ILS, VOR, DME (accurate slant-range DME for VORs and ILSs, and only when DME is present), NDB, and Outer, Middle and Inner markers. These Instrument Pilot's Scenery sets are truly a monumental achievement.

Flight Assignment: A.T.P.

When we started work on Flight Assignment: A.T.P., we wrote a wish list of the types of new scenery technologies we wanted to incorporate into the ATP simulation. While not all of our wishes were granted, we were able to develop a good portion of them, and we set out to prove our abilities and demonstrate our capabilities with this simulation. We think you'll agree that ATP has the best scenery you've ever seen. Just wait until you see what's next!

Credits

Program Design and Development:
Doug Myers, Director
Mark Allender, Holly Hardyman, Randy Kirby, Christopher Manrique, Mark Pechnick, Michael J. Woodley

Aircraft Design:
Loren Kirkwood, Christopher Manrique

Instrument Panel Design:
Randy Kirby, Michelle Maase, Kathy Voelz

Scenery Design and Development:
Michael J. Woodley, Director
Mark Allender, Holly Hardyman, J. Libero Johnson, Christopher Manrique

Documentation:
Norm Olsen, Director
Lori Anderson, Michael J. Woodley

Maps:
Michelle Maase (with assistance from Lori Anderson and Christopher Manrique)

Illustrations:
Michelle Maase,

Special thanks to all ATP beta-testers for your invaluable feedback regarding the ATP simulation and documentation. Your comments were greatly appreciated, and your suggestions were incorporated into this manual wherever possible.

Appendix I. Keyboard Summary

Aircraft Controls

Flight Controls

Function	Keyboard	Keypad
pitch up (up elevator)		[2]
pitch down (down elevator)		[8]
roll left (left aileron)		[4]
roll right (right aileron)		[6]
neutralize roll (and yaw in auto-coordination mode)		[5]
fine pitch up (trim joystick/yoke)		[1]
fine pitch down (trim joystick/yoke)		[7]
yaw left (left rudder)	[<]	
yaw right (right rudder)	[>]	
neutralize rudder	[L]	
auto-coordination on/off toggle	[/]	
deploy flaps (one step)		[+]
retract flaps (one step)		[-]
deploy spoilers (one step)		[Ins]
retract spoilers (one step)		[Del]
reverse thrust (from idle)	[9]	
idle thrust	[0]	
decrease thrust	[-]	[3]
increase thrust	[=]	[9]
climb thrust	[I]	
full thrust	[\] or [backspace]	
brakes	[M]	
retract landing gear	[right bracket]	
extend landing gear	[left bracket]	

Aircraft Simulation Controls

Function	Keyboard	Keypad
primary/secondary instrument panel toggle	[tab]	
auto-taxi to preferred runway (in flight assignment modes)	[~]	
pause/restart simulation	[P]	
refresh screen display	[Esc]	

Navigation Controls

NOTE: All Navigation and View control functions are performed while holding down the [Shift] key.

Function	Keyboard
select NAV1	[Shift][1]
select NAV2	[Shift][2]
select DME	[Shift][3]
select ADF	[Shift][4]
select IRS	[Shift][5]
select RMI1	[Shift][6]
select RMI2	[Shift][7]
select heading bug	[Shift][8]
select airspeed bug	[Shift][;]
select radio altimeter bug	[Shift][']

The following eight keystroke combinations adjust the selected item (above).

increase full MHz frequency value (coarse increase bug setting)	[Shift][=]
decrease full MHz frequency value (coarse decrease bug setting)	[Shift][-]
increase fractional kHz frequency value (fine increase bug setting)	[Shift][right bracket]
decrease fractional kHz frequency value (fine decrease bug setting)	[Shift][left bracket]
increase OBS setting	[Shift][0]
decrease OBS setting	[Shift][9]
audible nav-transmitter ident. code on	[Shift][I]
audible nav-transmitter ident. code off	[Shift][O]
autopilot master on/off toggle	[Shift][Z]
autopilot heading toggle: heading bug/NAV1/NAV2/off	[Shift][X]
autopilot altitude toggle: altitude hold/off	[Shift][C]
decrease altimeter setting	[Shift][<]
increase altimeter setting	[Shift][>]

View Controls

NOTE: All Navigation and View control functions are performed while holding down the [Shift] key.

Function	Keyboard	Keypad
first 3D window on/off toggle	[Shift][backspace]	
second 3D window on/off toggle		[Shift][Num Lock]
map view on/off toggle		[Shift][Scroll Lock]
cycle through turned-on windows and select window to be adjusted		[Shift][Ins]
give selected window top overlap priority	[Shift][P]	
zoom in (selected window)		[Shift][+]
zoom out (selected window)		[Shift][-]
reset 1X zoom factor (selected window)	[Shift][N]	
cycle through selected 3D window view modes: cockpit/tower/spot	[Shift][Caps Lock]	
place tower at current aircraft location (in tower view mode)	[Shift][/]	
selected 3D window cockpit view direction:		
forward		[Shift][8]
left front		[Shift][7]
right front		[Shift][9]
left		[Shift][4]
right		[Shift][6]
left rear		[Shift][1]
right rear		[Shift][3]
rearward		[Shift][2]
down		[Shift][5]
adjust selected 3D window cockpit view:		
up	[Shift][T]	
down	[Shift][B]	
left	[Shift][F]	
right	[Shift][H]	
reset default window view	[Shift][G]	
second 3D window autoview:		
autoview on	[Shift][Q]	
autoview off	[Shift][tab]	

Communication Controls

NOTE: All Communication control functions are performed while holding down the [Ctrl] key.

Function	Keyboard
select COM1	[Ctrl][1]
select COM2	[Ctrl][2]
select XPNDR	[Ctrl][3]
The following four keystroke combinations adjust the selected item (above).	
increase full MHz frequency value (increase most-significant-digits value)	[Ctrl][=]
decrease full MHz frequency value (decrease most-significant-digits value)	[Ctrl][-]
increase fractional kHz frequency value (increase least-significant-digits value)	[Ctrl][right bracket]
decrease fractional kHz frequency value (decrease least-significant-digits value)	[Ctrl][left bracket]
"Roger" (readback transmission)	[Ctrl][Enter]
request repeat last transmission	[Ctrl][Caps Lock]
request/verify clearance	[Ctrl][X]
check in with new ATC facility	[Ctrl][tab]
request taxi for takeoff	[Ctrl][.]
request different runway	[Ctrl][/]
request new altitude	[Ctrl][A]
report leaving altitude	[Ctrl][Q]
request frequency change	[Ctrl][F]
request radar vectors	[Ctrl][V]
report traffic/runway in sight	[Ctrl][T]
report missed approach	[Ctrl][M]
request taxi to ramp	[Ctrl][,]
cancel clearance (exit flight assignment mode)	[Ctrl][C]

Simulation Controls

NOTE: All Simulation control functions are performed while holding down the [Alt] key.

Function	Keyboard	Keypad
quiet (sound off)	[Alt][Q]	
warning sounds only	[Alt][W]	
all sounds on	[Alt][E]	
start demo recording	[Alt][I]	
stop demo recording	[Alt][O]	
cycle through and select demo time recording interval: 1/5/15 seconds	[Alt][T]	
instant replay	[Alt][P]	
slew mode on/off toggle	[Alt][S]	
Slew Mode Controls		
move forward/backward		[8]/[2]
move left/right		[4]/[6]
move up/down	[Q]/[A]	
pitch up/down	[9]/[0]	
bank left/right		[7]/[9]
yaw left/right		[1]/[3]
stop all motion		[5]
reset pitch/bank/heading to zero	[Z]	
digits on/off toggle	[D]	
enable/disable keyboard flight control input	[Alt][K]	
enable/disable joystick/yoke flight control input	[Alt][J]	
calibrate joystick/yoke	[Alt][N]	
enable/disable mouse flight control input	[Alt][M]	
visual attitude indicator on/off toggle	[Alt][A]	
cruise scenery mask (all objects enabled)	[Alt][;]	
maneuver scenery mask (reduced objects, same complexity)	[Alt][']	
final approach scenery mask (high-speed runway scenery only, increased complexity)	[Alt][Enter]	
decrease image complexity	[Alt][<]	
increase image complexity	[Alt][>]	
auto complexity on/off toggle	[Alt][/]	
shader on/off toggle	[Alt][Caps Lock]	
scenery load	[Alt][L]	

Simulation Controls (continued)

NOTE: All Simulation control functions are performed while holding down the [Alt] key.

Function	Keyboard	Keypad
accelerate time		[Alt][+]
decelerate time		[Alt][-]
16X time		[Alt][Ins]
reset 1X time		[Alt][Del]
load Hotkey mode 1	[Alt][Ctrl][1]	
load Hotkey mode 2	[Alt][Ctrl][2]	
load Hotkey mode 3	[Alt][Ctrl][3]	
load Hotkey mode 4	[Alt][Ctrl][4]	
load Hotkey mode 5	[Alt][Ctrl][5]	
load Hotkey mode 6	[Alt][Ctrl][6]	
load Hotkey mode 7	[Alt][Ctrl][7]	
load Hotkey mode 8	[Alt][Ctrl][8]	
load Hotkey mode 9	[Alt][Ctrl][9]	
reset to start of currently loaded flight mode	[Alt][Ctrl][0]	
exit the program (from normal flight mode)	[Alt][X]	

Menu Selection

NOTE: The keyboard Function keys are used to bring up all simulation control and configuration menus.

Menu	Key
Flight Modes menu	[F1]
Mode Library menu	[F2]
Environment menu	[F3]
Views menu	[F4]
Graphics menu	[F5]
Aircraft menu	[F6]
Flight Planning menu	[F7]
Status Report menu	[F9]
Help menu	[F10]

Appendix II. Using a Mouse, Joysticks, and Flight Controls I

A mouse can be used for menu selection and aircraft flight control. One or two joysticks or SubLOGIC Flight Controls I can be used for aircraft flight control.

Using a Mouse

Install the mouse hardware into your system (if it isn't already installed) according to the manufacturer's instructions. Before running the ATP program, install a Microsoft-compatible mouse driver either by putting a MOUSE.SYS command line into your CONFIG.SYS file or by running the MOUSE.COM program that comes with the mouse. Your mouse instruction manual tells how to install the mouse.

Load and run the ATP program as usual, then press [Esc] to exit the demo program and place the aircraft at the startup location. You must press [Alt][M] while in normal flight mode to enable the control yoke (flight control) component of mouse input. If you like, you can also press [Alt][K] to disable keyboard flight control input when using a mouse to fly the aircraft.

Cursor and Control Yoke Modes

The mouse can operate in two different modes: cursor and control yoke. Press the right mouse button to toggle between cursor and control yoke modes.

In cursor mode, the mouse is used to select menu items as usual by pointing at an item and clicking the left mouse button. Several types of instrument adjustments may also be made in mouse cursor mode by pointing at an instrument on the instrument panel and pressing the left mouse button to adjust it (clock, radios, etc.). Pointing and clicking to the left side of an instrument's digits decreases the setting, and clicking to the right side increases it.

Press the right mouse button to go into control yoke mode. The mouse then becomes a flight control. Figure II.1 summarizes the flight control functions in this mode. Press the right mouse button again to return to cursor mode.

In mouse control yoke mode, forward and backward mouse movements control the aircraft elevator, and cause the nose of the aircraft to pitch down or pitch up. Left and right movements control the aileron, and allow you to bank the aircraft to the left or to the right. Moving the mouse forward or backward while holding the left mouse button increases or decreases thrust. Holding the left mouse button and moving the mouse to the left applies brakes, while holding the left mouse button and moving the mouse to the right releases the brakes. The aircraft control position indicators on the primary instrument panel move as usual to indicate the current flight control settings.

IMPORTANT NOTE: You can determine if cursor or control yoke mode is in effect by the presence or absence of the cursor on the screen. A visible cursor indicates that you are in cursor mode.

Adjusting Sensitivities

Select option 5, Mouse Sensitivity, on the [F6] Aircraft menu to turn on the mouse sensitivity sub-menu. Menu options 1, 2, and 3 let you separately adjust mouse sensitivity along each axis in control yoke mode, and adjust overall mouse sensitivity in cursor mode. The mouse sensitivity menu options have sliders that can be dragged with the mouse, or set manually by selecting the slider number on the keyboard and pressing the appropriate keyboard number key followed by [Esc]. A slider value of 1 sets low sensitivity (large mouse movements are required to make slight yoke or cursor movements), while a value of 8 sets the highest sensitivity. Option 4, Null Zone, is used to specify how large a "dead zone" you will have between the mouse left and right movements that adjust aileron position in control yoke mode. Ailerons remain centered when the mouse is in the null zone, preventing the aircraft from drifting into a bank due to a slightly off-center aileron setting.

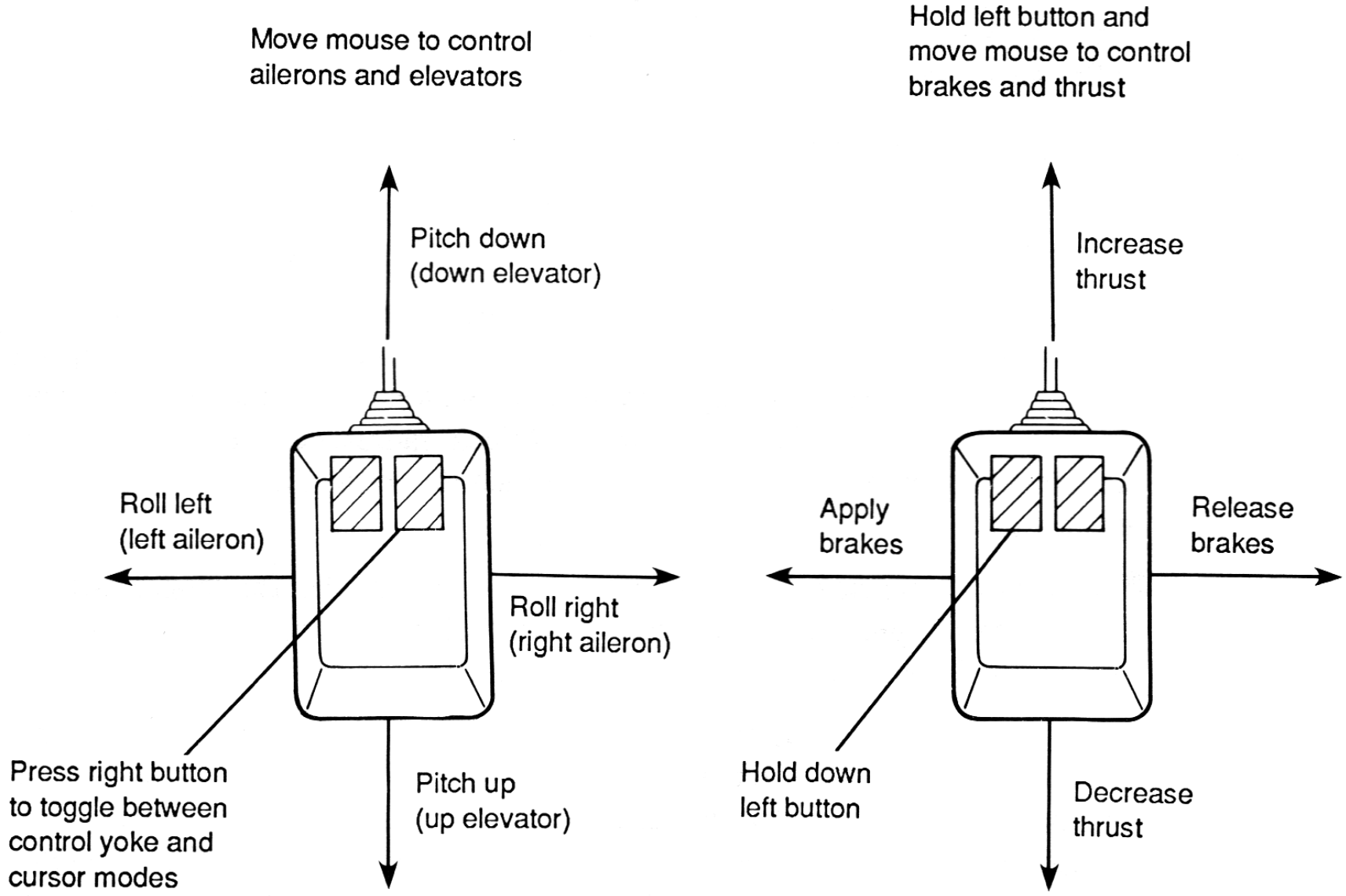

Move mouse to control ailerons and elevators
Hold left button and move mouse to control brakes and thrust
Pitch down (down elevator)
Roll left (left aileron)
Roll right (right aileron)
Pitch up (up elevator)
Press right button to toggle between control yoke and cursor modes
Increase thrust
Apply brakes
Release brakes
Hold down left button
Decrease thrust

Figure II.1. Control Yoke Mode Mouse Functions

Using Joysticks

Figure II.2 shows joystick control functions.

Setup

Connect one or two joysticks to an IBM Game Control Adapter Card (or equivalent). A Y-adapter may be necessary to handle two joysticks, and a computer store or joystick supplier can help get one if needed. Install the Game Control Adapter Card into your computer system according to the manufacturer's instructions.

Both joysticks can be either self-centering or noncentering along the left-right axis, to control the aircraft's ailerons and rudder. Joystick B *must* be noncentering along the forward-backward axis. You cannot use a self-centering joystick to control the throttle.

Joystick Selection and Sensitivity Adjustments

To use joysticks, load and run the ATP program and select the [F6] Aircraft menu from normal flight mode. Select option 6, Joystick/Yoke Sensitivity, to turn on a sub-menu that lets you specify one or two joysticks. On the menu, select Joystick A and/or Joystick B. A + symbol next to the item shows that it's active.

Joystick A (left stick) controls the ailerons and elevator (and the rudder when auto coordination is activated). Joystick A left or right firebuttons may be used to retract or deploy flaps respectively, at a rate of one step per second when the button is depressed. Joystick B (right stick) is used to control the throttle and rudder. The joystick B left firebutton may be used to apply brakes when on the ground, and the joystick B right firebutton may be used to retract/extend landing gear when the aircraft is airborne.

The joystick/yoke sensitivity sub-menu also lets you adjust joystick sensitivities. Specify joystick A and joystick B sensitivities along each axis by dragging the sliders to the desired position. Alternatively, select the slider number on the keyboard, then press the keyboard number corresponding to the desired slider position. The slider will move to the new location. Press [Esc] to set the slider into position and return to normal option-selection mode. A slider value of 1 sets low sensitivity (large joystick movements are required to make slight yoke/throttle adjustments), while a value of 8 sets the highest sensitivity.

Use options 7 and 8 to specify joystick A and joystick B null zone width (how large a dead space around each joystick's center position will be used).

Press [space bar] to return to normal flight mode when you're finished making menu selections. You must press [Alt][J] while in normal flight mode to enable joystick flight control input. If you like, you can also press [Alt][K] to disable keyboard flight control input when using *both* joysticks to fly the aircraft. The mouse still may be used in both cursor and yoke modes when joysticks are activated, or you can press [Alt][M] to disable the control yoke component of mouse input.

Joystick Calibration

Make sure you have enabled joystick flight control input (press [Alt][J] one time in normal flight mode). Move joystick A to its center position. Move joystick B all the way back and center. Center the trim controls if your joystick has them, then press [Alt][N] while in normal flight mode to calibrate the joystick centers.

When properly calibrated, joystick A should provide full aileron control left to right, and complete elevator control from full forward to full back. Both ailerons and elevator should be centered when joystick A is centered. Joystick B should provide full thrust control from top to bottom, and full rudder control from left to right. Adjust joystick sensitivities as necessary on the Joystick/Yoke Sensitivity menu to ensure proper calibration and flight control response.

The ATP aileron, elevator and rudder joystick control drivers are designed to provide more response the farther away from center you move the stick. When flying the aircraft, use the keypad elevator trim keys (see Chapter 5) to maintain level flight when joystick A is centered. Use the joystick trim dials to keep the flight controls centered if the joystick calibrations start to drift. If necessary, reposition both joysticks as described above and press [Alt][N] again to recalibrate joystick centers.

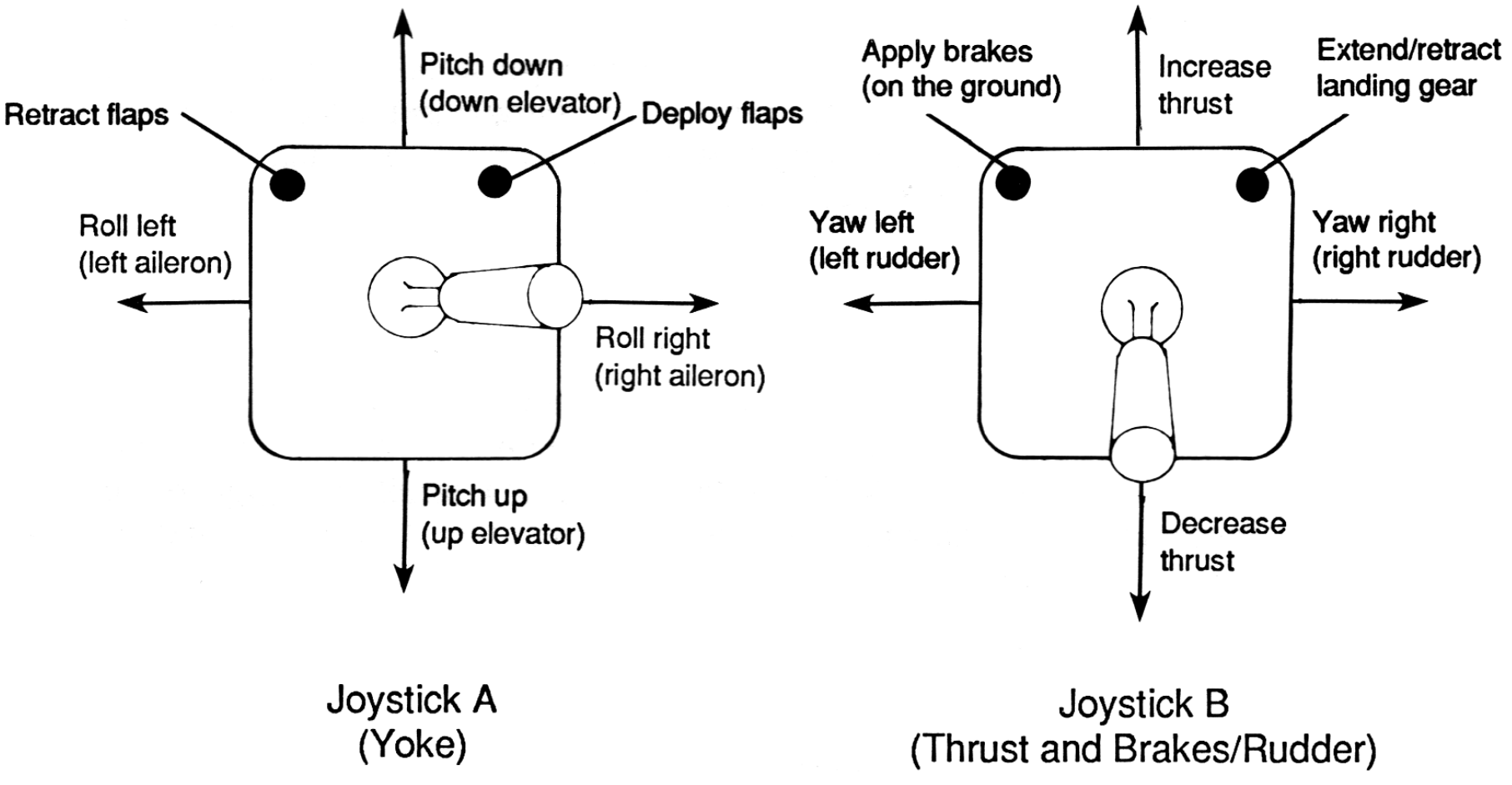


Figure II.2. Joystick Functions

Using Flight Controls I

SubLOGIC Flight Controls I can be used to greatly enhance simulation realism when flying any of the aircraft available with the ATP simulation. Flight Controls I features include a realistic control yoke, a throttle, and gear and flap switches. All controls function just like those found on a real aircraft (see Figure II.3). Optional rudder pedals are also separately available.

Setup

Connect Flight Controls I to an IBM Game Control Adapter Card (or equivalent) as described in the Flight Controls I installation instructions. These instructions also describe how to connect the (optional) rudder pedals. Install the Game Control Adapter Card into your computer system according to the manufacturer's instructions.

Flight Controls I Selection and Sensitivity Adjustments

Start the ATP program and select the [F6] Aircraft menu from normal flight mode. Select option 6, Joystick/Yoke Sensitivity, and select both the Joystick A and Joystick B options (a + symbol next to each item shows that it's active) on the joystick/yoke sensitivity sub-menu. The control yoke is used to control ailerons and elevator (and the rudder when auto coordination is activated), the flap switch raises and lowers the flaps, the throttle adjusts thrust, and the gear switch extends and retracts the landing gear.

The joystick/yoke sensitivity sub-menu also lets you adjust yoke and throttle sensitivities. Specify aileron and elevator control sensitivities by using a mouse to drag the option 3 and 4 sliders to the desired position, or select the slider number on the keyboard and press the appropriate keyboard number followed by [Esc]. Use option 5 to adjust throttle sensitivity as desired. A slider value of 1 sets low sensitivity (large yoke and/or throttle movements are required to make small control adjustments), while a value of 8 sets the highest sensitivity.

Use option 7 to specify an aileron-control null zone width (how large a dead space around the control yoke's center position will be used when making left/right aileron control adjustments). If you are using rudder pedals with Flight Controls I, use option 6 to adjust rudder sensitivity, and use option 8 to specify a rudder pedal center position null zone width.

Press [space bar] to return to normal flight mode when you're finished making menu selections. You must press [Alt][J] while in normal flight mode to enable flight control input. If you like, you can also press [Alt][K] to disable keyboard flight control input when using Flight Controls I to fly the aircraft. The mouse still may be used in both cursor and yoke modes when Flight Controls I are activated, or you can press [Alt][M] to disable the control yoke component of mouse input.

Flight Controls I Calibration and Use

Move the control yoke to its level center position, move the throttle all the way down, set the gear switch in the down (extended) position, and set the flap switch to the up position. Center the rudder pedals if you are using them. Press [Alt][N] while in normal flight mode to calibrate all flight controls.

The control yoke should provide full aileron control left to right, and complete elevator control from full forward to full back. Both ailerons and elevator should be centered when the control yoke is level and centered. The throttle should provide full thrust control. Rudder pedals should provide complete rudder control from full left to full right pedal application. You may have to adjust control yoke, throttle and/or rudder sensitivities on the joystick/yoke sensitivity sub-menu to ensure proper control calibration and throttle response. Gear and flap switches are used to extend/retract the landing gear and to adjust flaps position respectively.

Due to the smooth bearing design of the control yoke, we recommend that you use only your left hand to make control yoke adjustments so you can practice keeping the right hand on the throttle during takeoff. This is to prevent slippage, and to ensure that you will be ready to abort takeoff in an emergency. Flap switch delays operate the flaps at about 10 degrees per second of switch operation. Landing gear is operated with a 3-position gear switch, which may be unusual for light airplane pilots. In reality, most transport pilots set the gear switch to the center position after gear retraction.

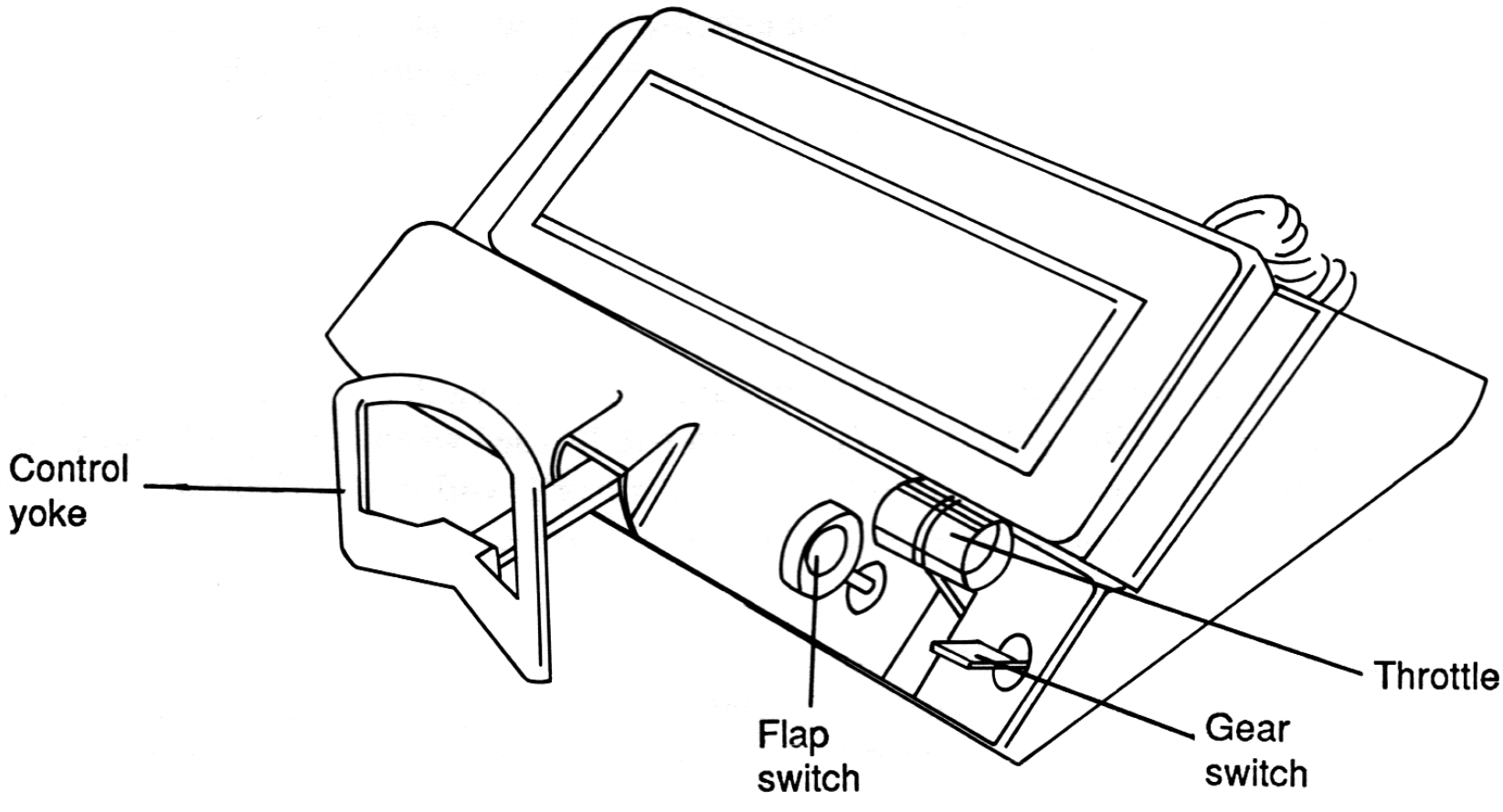


Figure II.3. Flight Controls I

Appendix III. Airport Listings

The twenty-six primary airports included with Flight Assignment: A.T.P. are listed in alphabetical order by city. Each of the primary airports has at least one runway long enough to accomodate all of the aircraft you can fly with ATP. Airport diagrams (taxi charts) for the twenty-six major airports are provided in Appendix IV of this manual. These airports support a variety of instrument approaches. Instrument approach charts are also provided in Appendix IV for the approaches marked with an asterisk. Refueling facilities are available at all primary airports.

Over 330 secondary airports are also available. Secondary airports have refueling facilities and at least one runway long enough for you to land at when flying the Shorts 360 twin-engine turboprop. These airports are listed separately, and are alphabetized by airport identifier (the three- or four-letter code used to identify them on the large area maps included with the ATP program).

Primary Airports

Airport	Runway	Dimensions	Approach	DME	Ident.	Freq.
Albuquerque, NM	RWY 3-21	7436x150				
Albuquerque Intl (ABQ)	RWY 8-26	13375x300	* ILS RWY 8	DME	I-SPT	111.90
Latitude: 35° 02' 31.5" N			* VOR RWY 8 (TAC)	DME	ABQ	113.20
Longitude: 106° 36' 23.2" W	RWY 12-30	5130x150				
North: 14806	RWY 17-35	10010x150				
East: 9990						
Elevation: 5352						
Atlanta, GA	RWY 8L-26R	9000x150	ILS RWY 8L		I-HFW	109.30
William B. Hartsfield			ILS RWY 26R		I-GXZ	110.10
Atlanta Intl (ATL)	RWY 8R-26L	10000x150	* ILS RWY 8R (CAT II)	DME	I-ATL	109.90
Latitude: 33° 38' 25.2" N			* ILS RWY 26L		I-BRU	108.70
Longitude: 84° 25' 37.2"	RWY 9L-27R	11889x150	* ILS RWY 9L		I-HZK	110.50
North: 13680			* ILS RWY 27R		I-AFA	111.30
East: 17867	RWY 9R-27L	9000x150	* ILS RWY 9R (CAT II)	DME	I-FUN	108.90
Elevation: 1026			ILS RWY 27L		I-FSQ	108.50
Boston, MA	RWY 4L-22R	7860x150				
General Edward Lawrence	RWY 4R-22L	10005x150	* ILS RWY 4R (CAT II)	DME	I-BOS	110.30
Logan Intl (BOS)	RWY 9-27	7000x150	* ILS/DME RWY 27	DME	I-DGU	111.30
Latitude: 42° 21' 51" N	RWY 15L-33R	2557x100				
Longitude: 71° 00' 21" W	RWY 15R-33L	10081x150	* ILS/DME RWY 33L	DME	I-LIP	110.70
North: 17995						
East: 21919						
Elevation: 20						

* See instrument approach chart in Appendix IV.

Airport	Runway	Dimensions	Approach	DME	Ident.	Freq.
Chicago, IL	RWY 4L-22R	7500x150	ILS RWY 22R		I-RXZ	111.30
Chicago-O'Hare Intl (ORD)	RWY 4R-22L	8071x150	ILS RWY 22L		I-LQQ	110.10
Latitude: 41° 58' 46.4" N	RWY 9L-27R	7966x150	ILS RWY 9L		I-JAV	110.50
Longitude: 87° 54' 15.8" W			ILS RWY 27R		I-IAC	110.50
North: 17232	RWY 9R-27L	10141x150	ILS RWY 9R	DME	I-MED	111.10
East: 16546			* ILS RWY 27L	DME	I-TSL	111.10
Elevation: 667	RWY 14L-32R	10003x150	* ILS RWY 14L (CAT II)	DME	I-OHA	110.90
			ILS RWY 32R		I-IDN	110.70
	RWY 14R-32L	13000x200	* ILS RWY 14R (CAT II)	DME	I-ORD	109.70
			ILS RWY 32L	DME	I-RVG	109.10
	RWY 18-36	5341x150				
Cleveland, OH	RWY 5L-23R	7096x150				
Cleveland-Hopkins Intl (CLE)	RWY 5R-23L	8999x150	* ILS RWY 5R (CAT II)		I-CLE	111.90
Latitude: 41° 24' 39" N			* ILS RWY 23L	DME	I-HPI	109.90
Longitude: 81° 50' 58.3" W	RWY 10-28	6015x150	ILS RWY 28		I-PXP	110.70
North: 17087	RWY 18-36	6410x150				
East: 18516						
Elevation: 792						
Dallas/Fort Worth, TX	RWY 13L-31R	9000x200	ILS RWY 31R		I-RRA	110.90
Dallas-Fort Worth Intl (DFW)	RWY 13R-31L	9300x150	* ILS-1 RWY 13R	DME	I-LWN	109.50
Latitude: 32° 53' 46.7" N	RWY 17L-35R	11388x150	* ILS-1 RWY 17L (CAT II)	DME	I-FLQ	109.10
Longitude: 97° 02' 28.2" W			ILS RWY 35R	DME	I-PKQ	109.10
North: 13421	RWY 17R-35L	11388x200	* ILS-2 RWY 17R		I-JHZ	111.50
East: 13279	RWY 18L-36R	11387x200	* ILS-2 RWY 18L		I-CIX	111.30
Elevation: 603	RWY 18R-36L	11388x150	* ILS-1 RWY 18R (CAT II)	DME	I-VYN	111.90
			ILS RWY 36L	DME	I-BXN	111.90
	RWY 18S-36S	4000x100				
Denver, CO	RWY 7-25	4871x75				
Stapleton Intl (DEN)	RWY 8L-26R	8599x150				
Latitude: 39° 46' 27.5" N	RWY 8R-26L	10004x150	ILS RWY 8R	DME	I-GQW	111.50
Longitude: 104° 52' 45.2" W			* ILS RWY 26L	DME	I-DEN	110.30
North: 16708	RWY 17L-35R	12000x200	* ILS/DME-1 RWY 17L		I-HMX	111.10
East: 10937			ILS RWY 35R	DME	I-RRV	109.30
Elevation: 5333	RWY 17R-35L	11500x150	ILS RWY 35L	DME	I-SPO	110.70
	RWY 18-36	7750x100				
Detroit, MI	RWY 3C-21C	8500x200				
Detroit Metropolitan	RWY 3L-21R	10501x200	* ILS RWY 3L (CAT II)	DME	I-DTW	110.70
Wayne County (DTW)	RWY 3R-21L	10000x150	* ILS RWY 3R (CAT II)		I-HUU	111.50
Latitude: 42° 12' 54.8" N	RWY 9-27	8700x200	* ILS RWY 27		I-DMI	108.50
Longitude: 83° 20' 55.3"						
North: 17397						
East: 18006						
Elevation: 639						

* See instrument approach chart in Appendix IV.

Airport	Runway	Dimensions	Approach	DME	Ident.	Freq.
Houston, TX	RWY 8-26	9401x150	* ILS RWY 8	DME	I-IAH	109.70
Houston Intercontinental (IAH)	RWY 9-27	9999x150	* ILS RWY 9	DME	I-UYO	110.90
Latitude: 29° 58' 48.9" N			* ILS RWY 27 (CAT II)	DME	I-GHI	110.90
Longitude: 95° 20' 22.2" W	RWY 14L-32R	12001x150	* ILS RWY 14L		I-HSQ	111.90
North: 12111			ILS RWY 32R		I-CDG	111.90
East: 13818	RWY 14R-32L	6038x100				
Elevation: 98						
Kansas City, MO	RWY 1-19	10801x150	ILS RWY 1		I-DOT	110.50
Kansas City Intl (MCI)			* ILS RWY 19 (CAT II)		I-PAJ	109.10
Latitude: 39° 17' 57.2" N	RWY 9-27	9500x150	* ILS RWY 9	DME	I-RNI	109.70
Longitude: 94° 43' 03.8" W						
North: 16122						
East: 14285						
Elevation: 1026						
Las Vegas, NV	RWY 1L-19R	5001x75				
McCarran Intl (LAS)	RWY 1R-19L	9776x150				
Latitude: 36° 04' 58" N	RWY 7-25	12636x150	* ILS RWY 25	DME	I-LAS	110.30
Longitude: 115° 09' 12.9" W			* VOR RWY 25	DME	LAS	116.90
North: 15945						
East: 7162						
Elevation: 2174						
Los Angeles, CA	RWY 6L-24R	8925x150	* ILS RWY 24R (CAT II)	DME	I-OSS	108.50
Los Angeles Intl (LAX)	RWY 6R-25L	10285x150	* ILS RWY 6R	DME	I-GPE	111.70
Latitude: 33° 56' 33.1" N			* ILS RWY 25L (CAT II)	DME	I-LAX	109.90
Longitude: 118° 24' 25.8" W	RWY 7L-25R	12091x150				
North: 15404	RWY 7R-25L	11096x200	* ILS RWY 7R	DME	I-MKZ	111.10
East: 5784						
Elevation: 126						
Miami, FL	RWY 9L-27R	10502x200	ILS RWY 9L	DME	I-MFA	110.30
Miami Intl (MIA)			ILS RWY 27R		I-VIN	109.10
Latitude: 25° 47' 34" N	RWY 9R-27L	13002x150	* ILS RWY 9R		I-BUL	110.90
Longitude: 80° 17' 26" W			* ILS RWY 27L		I-MIA	109.50
North: 10390	RWY 12-30	9355x150	* ILS RWY 12	DME	I-GEM	108.90
East: 19706						
Elevation: 11						
Minneapolis, MN	RWY 4-22	8256x150	ILS RWY 4		I-APL	109.30
Minneapolis-St. Paul Intl			ILS RWY 22		I-SIJ	110.50
(Wold-Chamberlain) (MSP)	RWY 11L-29R	8202x150	ILS RWY 11L		I-PJL	110.70
Latitude: 44° 53' 03.2" N			* ILS RWY 29R		I-INN	109.90
Longitude: 93° 12' 53.5" W	RWY 11R-29L	10000x200	ILS RWY 11R	DME	I-HKZ	110.30
North: 18509			* ILS RWY 29L (CAT II)	DME	I-MSP	110.30
East: 14886						
Elevation: 841						

* See instrument approach chart in Appendix IV.

Airport	Runway	Dimensions	Approach	DME	Ident.	Freq.
New Orleans, LA	RWY 1-19	7000x150	ILS RWY 1	DME	I-JFI	111.70
New Orleans Intl/			* LOC BC RWY 19	DME	I-JFI	111.70
Moisant Field (MSY)	RWY 6-24	4542x150				
Latitude: 29° 59' 34.4" N	RWY 10-28	9228x150	ILS RWY 10	DME	I-MSY	109.90
Longitude: 90° 15' 22.9" W			* ILS RWY 28	DME	I-HOX	109.90
North: 12047						
East: 15745						
Elevation: 4						
New York, NY	RWY 4L-22R	11351x150	* ILS RWY 4L	DME	I-HIQ	110.90
John F. Kennedy Intl (JFK)	RWY 4R-22L	8400x150	* ILS RWY 4R (CAT II)	DME	I-JFK	109.50
Latitude: 40° 38' 24.5" N	RWY 13L-31R	10000x150	* ILS RWY 13L (CAT II)	DME	I-TLK	111.50
Longitude: 73° 46' 41.9" W			ILS RWY 31R	DME	I-RTH	111.50
North: 17096	RWY 13R-31L	14572x150	* ILS RWY 31L	DME	I-MOH	110.90
East: 21174						
Elevation: 13						
Philadelphia, PA	RWY 9L-27R	9500x150	* ILS RWY 27R	DME	I-PDP	109.35
Philadelphia Intl (PHL)	RWY 9R-27L	10499x200	ILS RWY 9R	DME	I-PHL	109.30
Latitude: 39° 52' 12.9" N			* ILS RWY 27L	DME	I-GLC	109.30
Longitude: 75° 14' 43.4" W	RWY 17-35	5459x150	ILS RWY 17		I-MYY	108.75
North: 16688						
East: 20750						
Elevation: 21						
Phoenix, AZ	RWY 8L-26R	11001x150				
Phoenix Sky Harbor Intl (PHX)	RWY 8R-26L	10300x150	* ILS RWY 8R	DME	I-PHX	108.30
Latitude: 33° 26' 09.8" N			* LOC BC RWY 26L	DME	I-PHX	108.30
Longitude: 112° 00' 31.7" W						
North: 14547						
East: 7945						
Elevation: 1132						
Pittsburgh, PA	RWY 10C-28C	8040x150				
Greater Pittsburgh Intl (PIT)	RWY 10L-28R	10502x150				
Latitude: 40° 29' 29.3" N	RWY 10R-28L	11500x200	* ILS RWY 10R		I-GUT	108.90
Longitude: 80° 13' 57.5" W			* ILS RWY 28L		I-PFS	108.90
North: 16741	RWY 14-32	8101x150	* ILS RWY 32		I-TQW	111.30
East: 19079						
Elevation: 1203						
St. Louis, MO	RWY 6-24	7602x150	* LOC BC RWY 6	DME	I-STL	110.30
Lambert-St. Louis Intl (STL)			* ILS RWY 24	DME	I-STL	110.30
Latitude: 38° 44' 52" N	RWY 12L-30R	9003x150	ILS RWY 12L		I-LDZ	108.90
Longitude: 90° 21' 36" W			* ILS RWY 30R (CAT II)		I-SJW	111.30
North: 15836	RWY 12R-30L	11019x200	* ILS RWY 12R		I-LMR	109.70
East: 15742			ILS RWY 30L		I-BKY	111.50
Elevation: 605	RWY 13-31	6289x75				
	RWY 17-35	3008x75				

* See instrument approach chart in Appendix IV.

Airport	Runway	Dimensions	Approach	DME	Ident.	Freq.
Salt Lake City, UT	RWY 14-32	5295x150				
Salt Lake City Intl (SLC)	RWY 16L-34R	9596x150	ILS RWY 16L	DME	I-BNT	111.50
Latitude: 40° 47' 12.6" N	RWY 16R-34L	12003x150	* ILS/DME RWY 16R	DME	I-MOY	110.70
Longitude: 111° 58' 04.8" W			* ILS RWY 34L (CAT II)		I-SLC	109.50
North: 17619						
East: 8736						
Elevation: 4227						
San Diego, CA	RWY 9-27	9400x200	* ILS RWY 9	DME	I-SAN	110.90
San Diego Intl-	RWY 13-31	4439x75				
Lindbergh Field (SAN)						
Latitude: 32° 44' 00.6" N						
Longitude: 117° 11' 12.1" W						
North: 14770						
East: 6046						
Elevation: 15						
San Francisco, CA	RWY 1L-19R	7001x200				
San Francisco Intl (SFO)	RWY 1R-19L	8901x200	* ILS RWY 19L	DME	I-SIA	108.90
Latitude: 37° 37' 08.6" N	RWY 10L-28R	11870x200	* ILS RWY 28R (CAT II)	DME	I-GWQ	111.70
Longitude: 122° 22' 25.5" W	RWY 10R-28L	10600x200	* ILS RWY 28L		I-SFO	109.50
North: 17364						
East: 4998						
Elevation: 11						
Seattle, WA	RWY 16L-34R	11900x150	* ILS RWY 34R		I-SEA	110.30
Seattle-Tacoma Intl (SEA)	RWY 16R-34L	9425x150	* ILS RWY 16R (CAT II)	DME	I-SZI	111.70
Latitude: 47° 26' 57" N						
Longitude: 122° 18' 29.1" W						
North: 21338						
East: 6522						
Elevation: 429						
Tampa, FL	RWY 9-27	6998x150				
Tampa Intl (TPA)	RWY 18L-36R	8300x150	* ILS RWY 18L		I-TPA	110.30
Latitude: 27° 58' 30.6" N			* LOC BC RWY 36R		I-TPA	110.30
Longitude: 82° 32' 00.4" W	RWY 18R-36L	11002x150	* ILS RWY 18R	DME	I-JRT	108.50
North: 11267			* ILS RWY 36L (CAT II)		I-AMP	108.90
East: 18740						
Elevation: 27						
Washington, DC	RWY 1L-19R	11501x150	ILS RWY 1L		I-OSZ	111.30
Washington Dulles Intl (IAD)			* ILS-1 RWY 19R		I-DLX	111.30
Latitude: 38° 56' 39" N	RWY 1R-19L	11500x150	* ILS RWY 1R (CAT II)		I-IAD	110.10
Longitude: 77° 27' 26.3" W			* ILS-1 RWY 19L		I-SGC	110.10
North: 16187	RWY 12-30	10001x150	* ILS-1 RWY 12		I-AJU	109.30
East: 20076						
Elevation: 313						

* See instrument approach chart in Appendix IV.

Secondary Airports

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
04V	Saguache Muni	Saguache, CO	38° 05' 50" N	106° 10' 05" W	16073	10383	7826
0V7	Kayenta	Kayenta, AZ	36° 42' 35" N	110° 14' 10" W	15774	8891	5710
1V8	Leach	Center, CO	37° 47' 05" N	106° 02' 16" W	15933	10402	7598
21XS	Big Spring McMahon-Wrinkle	Big Spring, TX	32° 12' 44.8" N	101° 31' 16.5" W	13303	11612	2572
24E	San Carlos	San Carlos, AZ	33° 22' 40" N	110° 27' 40" W	14390	8485	2896
31J	Lake City Muni	Lake City, FL	30° 11' 00" N	82° 34' 45" W	12228	18648	202
3R6	Stennis Intl	Bay St. Louis, MS	30° 22' 03.4" N	89° 27' 16.4" W	12209	16049	23
4SD	Reno/Stead	Reno, NV	39° 40' 16" N	119° 52' 39" W	17908	6093	5046
4U9	Dell Flight Strip	Dell, MT	44° 44' 09" N	112° 43' 09" W	19333	8929	6007
5T6	Santa Teresa	Santa Teresa, NM	31° 52' 40" N	106° 42' 30" W	13467	9696	4110
7A1	Donaldson Center	Greenville, SC	34° 45' 30" N	82° 22' 36" W	14212	18570	955
7V1	Buena Vista Muni	Buena Vista, CO	38° 49' 00" N	106° 07' 14" W	16375	10455	7980
9U8	Currie	Currie, NV	40° 16' 59" N	114° 45' 57" W	17649	7790	5900
ABE	Allentown-Bethlehem-Easton	Allentown, PA	40° 39' 10.9" N	75° 26' 24.5" W	17012	20634	394
ABI	Abilene Regional	Abilene, TX	32° 24' 40.3" N	99° 40' 53.5" W	13306	12295	1790
ACY	Atlantic City Intl	Atlantic City, NJ	39° 27' 26.8" N	74° 34' 39.2" W	16548	20999	76
ADM	Ardmore Muni	Ardmore, OK	34° 18' 12.2" N	97° 01' 01" W	14027	13338	762
ADS	Addison	Dallas, TX	32° 58' 06.4" N	96° 50' 10.2" W	13446	13356	643
AEG	Double Eagle II	Albuquerque, NM	35° 08' 42.4" N	106° 47' 40.5" W	14862	9932	5834
AGS	Bush Field	Augusta, GA	33° 22' 11.3" N	81° 57' 52.8" W	13625	18766	145
AIA	Alliance Muni	Alliance, NE	42° 03' 11.8" N	102° 48' 11.7" W	17573	11763	3929
AL08	Vaiden Field	Marion, AL	32° 30' 44" N	87° 23' 08" W	13149	16808	225
ALB	Albany County	Albany, NY	42° 44' 52.9" N	73° 48' 12.3" W	17991	21010	285
ALM	Alamogordo-White Sands Regional	Alamogordo, NM	32° 50' 23.5" N	105° 59' 24.2" W	13828	10033	4197
ALO	Waterloo Muni	Waterloo, IA	42° 33' 24.7" N	92° 24' 00.4" W	17492	15105	873
ALS	San Luis Valley Regional/Bergman Field	Alamosa, CO	37° 26' 09.8" N	105° 51' 55.6" W	15774	10433	7535
ALW	Walla Walla City County	Walla Walla, WA	46° 05' 40.9" N	118° 17' 13.1" W	20380	7462	1205
AMA	Amarillo Intl	Amarillo, TX	35° 13' 09.6" N	101° 42' 19.7" W	14602	11719	3605
ANB	Anniston Metropolitan	Anniston, AL	33° 35' 17" N	85° 51' 29.3" W	13633	17350	611
APA	Centennial	Denver, CO	39° 34' 12.5" N	104° 50' 55.5" W	16620	10933	5883
APN	Alpena County Regional	Alpena, MI	45° 04' 41" N	83° 33' 37.1" W	18629	17857	689
ARA	Acadiana Regional	New Iberia, LA	30° 02' 15.2" N	91° 53' 01.6" W	12077	15128	24
ATW	Outagamie County	Appleton, WI	44° 15' 26.7" N	88° 31' 09.7" W	18215	16338	917
AUS	Robert Mueller Muni	Austin, TX	30° 17' 53.4" N	97° 42' 04.7" W	12318	12937	632
AVL	Asheville Regional	Asheville, NC	35° 26' 09.8" N	82° 32' 31.1" W	14500	18488	2165
AVP	Wilkes-Barre/ Scranton Intl	Wilkes-Barre/ Scranton, PA	41° 20' 18.4" N	75° 43' 26" W	17290	20497	962
BAF	Barnes Muni	Westfield, MA	42° 09' 27.5" N	72° 42' 57.9" W	17802	21398	271
BAM	Lander County	Battle Mountain, NV	40° 35' 54" N	116° 52' 28" W	17978	7163	4532
BCE	Bryce Canyon	Bryce Canyon, UT	37° 42' 23" N	112° 08' 41" W	16347	8352	7586
BDL	Bradley Intl	Windsor Locks, CT	41° 56' 19.5" N	72° 41' 01.2" W	17711	21425	174
BED	Laurence G. Hanscom Field	Bedford, MA	42° 28' 11.5" N	71° 17' 22.3" W	18022	21821	133
BFF	William B. Heilig Field	Scottsbluff, NE	41° 52' 33.9" N	103° 35' 53.4" W	17536	11498	3965

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
BFI	Boeing Field/ King County Intl	Seattle, WA	47° 31' 48.6" N	122° 18' 02.6" W	21370	6537	18
BFL	Meadows Field	Bakersfield, CA	35° 26' 01.1" N	119° 03' 21" W	16088	5768	507
BFM	Brookley	Mobile, AL	30° 37' 34.6" N	88° 04' 04.8" W	12326	16570	26
BGR	Bangor Intl	Bangor, ME	44° 48' 26.5" N	68° 49' 43.1" W	19175	22362	192
BHM	Birmingham	Birmingham, AL	33° 33' 49.6" N	86° 45' 16.3" W	13611	17026	644
BIH	Bishop	Bishop, CA	37° 22' 23.4" N	118° 21' 45.6" W	16805	6262	4120
BIL	Billings Logan Intl	Billings, MT	45° 48' 29.4" N	108° 32' 25.2" W	19491	10284	3649
BIS	Bismarck Muni	Bismarck, ND	46° 46' 26.5" N	100° 44' 50.6" W	19516	12672	1677
BJC	Jeffco	Denver, CO	39° 54' 30.4" N	105° 06' 56.7" W	16779	10870	5657
BKV	Hernando County	Brooksville, FL	28° 28' 12" N	82° 27' 30" W	11486	18752	76
BLI	Bellingham Intl	Bellingham, WA	48° 47' 47.2" N	122° 32' 14.1" W	21913	6668	158
BNA	Nashville Intl	Nashville, TN	36° 07' 31" N	86° 40' 35" W	14718	17020	599
BOI	Boise Air Terminal/ Gowen Field	Boise, ID	43° 33' 54.4" N	116° 13' 27.4" W	19142	7739	2858
BQK	Glynco Jetport	Brunswick, GA	31° 15' 31.7" N	81° 27' 59.4" W	12729	19027	26
BRO	Brownsville/South Padre Island Intl	Brownsville, TX	25° 54' 23.3" N	97° 25' 32.1" W	10392	12873	23
BTL	W.K. Kellogg	Battle Creek, MI	42° 18' 26.6" N	85° 15' 03.5" W	17401	17394	952
BTM	Bert Mooney	Butte, MT	45° 57' 11.8" N	112° 29' 44.5" W	19828	9129	5545
BTV	Burlington Intl	Burlington, VT	44° 28' 17.2" N	73° 09' 11.5" W	18762	21080	334
BUF	Greater Buffalo Intl	Buffalo, NY	42° 56' 25.7" N	78° 43' 56.7" W	17846	19446	724
BUR	Burbank-Glendale-Pasadena	Burbank, CA	34° 12' 02.1" N	118° 21' 27.2" W	15504	5836	775
BWI	Baltimore-Washington Intl	Baltimore, MD	39° 10' 30.4" N	76° 40' 09.6" W	16322	20324	146
BZN	Gallatin Field	Bozeman, MT	45° 46' 37.1" N	111° 09' 08" W	19654	9506	4474
CAE	Columbia Metropolitan	Columbia, SC	33° 56' 25.1" N	81° 07' 10.2" W	13898	19049	236
CAK	Akron-Canton Regional	Akron, OH	40° 54' 58.5" N	81° 26' 33.4" W	16886	18666	1228
CDC	Cedar City Muni	Cedar City, UT	37° 42' 05.8" N	113° 05' 50.1" W	16426	8036	5622
CEF	Westover Metropolitan	Springfield/ Chicopee, MA	42° 11' 52" N	72° 31' 50" W	17830	21453	245
CEW	Bob Sikes	Crestview, FL	30° 46' 47" N	86° 31' 21" W	12406	17150	215
CEZ	Cortez-Montezuma County	Cortez, CO	37° 18' 10.8" N	108° 37' 38.7" W	15902	9490	5914
CHA	Lovell Field	Chattanooga, TN	35° 02' 06.7" N	85° 12' 13.8" W	14268	17557	682
CID	Cedar Rapids Muni	Cedar Rapids, IA	41° 53' 04.4" N	91° 42' 31.4" W	17196	15319	864
CIU	Chippewa County Intl	Sault Ste. Marie, MI	46° 14' 52" N	84° 28' 15.4" W	19120	17549	799
CLL	Easterwood Field	College Station, TX	30° 35' 18.2" N	96° 21' 48.9" W	12402	13450	320
CLT	Charlotte/Douglas Intl	Charlotte, NC	35° 12' 51.9" N	80° 56' 37.1" W	14452	19060	749
CMH	Port Columbus Intl	Columbus, OH	39° 59' 42.4" N	82° 53' 10.6" W	16451	18224	816
CMI	University of Illinois-Willard	Champaign/ Urbana, IL	40° 02' 22.6" N	88° 16' 39.5" W	16393	16437	754
CNM	Cavern City Air Terminal	Carlsbad, NM	32° 20' 14.5" N	104° 15' 45.9" W	13505	10620	3293
CNW	Tsti-Waco	Waco, TX	31° 38' 12.3" N	97° 04' 20.2" W	12878	13222	469
COD	Yellowstone Regional	Cody, WY	44° 31' 12.2" N	109° 01' 24.4" W	18976	10021	5100
COE	Coeur D'Alene Air Terminal	Coeur D'Alene, ID	47° 46' 27.7" N	116° 49' 06.8" W	20945	8102	2318
COS	City of Colorado Springs Muni	Colorado Springs, CO	38° 48' 42.8" N	104° 42' 39.5" W	16290	10923	6172
CPR	Natrona County Intl	Casper, WY	42° 54' 29.6" N	106° 27' 46.8" W	18131	10670	5348

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
CPS	St. Louis Downtown-Parks	Cahokia/St. Louis, IL	38° 34' 17" N	90° 09' 26.3" W	15759	15810	413
CRP	Corpus Christi Intl	Corpus Christi, TX	27° 46' 12.2" N	97° 30' 03.4" W	11211	12915	44
CRW	Yeager	Charleston, WV	38° 22' 23" N	81° 35' 36" W	15789	18712	982
CSM	Clinton-Sherman	Clinton, OK	35° 20' 23.2" N	99° 12' 00.5" W	14547	12606	1922
CVG	Greater Cincinnati Intl	Covington/ Cincinnati, KY/OH	39° 02' 52.4" N	84° 39' 59.6" W	16007	17656	891
CWA	Central Wisconsin	Mosinee, WI	44° 46' 42.4" N	89° 39' 59" W	18440	15981	1277
CWF	Chennault Industrial Airpark	Lake Charles, LA	30° 12' 44.6" N	93° 08' 36" W	12169	14654	17
CYS	Cheyenne	Cheyenne, WY	41° 09' 20.7" N	104° 48' 44.4" W	17292	11059	6156
DAB	Daytona Beach Regional	Daytona Beach, FL	29° 10' 50.5" N	81° 03' 21.6" W	11841	19264	35
DAL	Dallas Love Field	Dallas, TX	32° 50' 49.2" N	96° 51' 05.4" W	13394	13346	487
DAY	James M. Cox Dayton Intl	Dayton, OH	39° 54' 03.6" N	84° 13' 12.4" W	16383	17785	1009
DCA	Washington National	Washington, DC	38° 51' 07.9" N	77° 02' 16.6" W	16167	20221	16
DEC	Decatur	Decatur, IL	39° 50' 04.7" N	88° 51' 59" W	16304	16243	682
DHN	Dothan	Dothan, AL	31° 19' 16.2" N	85° 26' 58.9" W	12657	17542	401
DLH	Duluth Intl	Duluth, MN	46° 50' 32.2" N	92° 11' 33.8" W	19349	15227	1430
DRA	Desert Rock	Mercury, NV	36° 37' 10" N	116° 01' 55" W	16254	6934	3314
DRO	Durango-La Plata County	Durango, CO	37° 09' 05.4" N	107° 45' 11.3" W	15777	9771	6685
DSM	Des Moines Intl	Des Moines, IA	41° 32' 05.8" N	93° 39' 37.7" W	17067	14683	957
DUG	Bisbee Douglas Intl	Douglas Bisbee, AZ	31° 28' 08.2" N	109° 36' 10.9" W	13512	8607	4151
DVT	Phoenix-Deer Valley Muni	Phoenix, AZ	33° 41' 17.6" N	112° 04' 53.5" W	14660	7947	1476
DWH	David Wayne Hooks Memorial	Houston, TX	30° 03' 41.8" N	95° 33' 09.1" W	12152	13739	152
EAR	Kearney Muni	Kearney, NE	40° 43' 36" N	99° 00' 15" W	16850	12917	2130
EAU	Eau Claire County	Eau Claire, WI	44° 51' 55.1" N	91° 29' 05.7" W	18484	15420	907
ECG	Elizabeth City CG Air Station/Muni	Elizabeth City, NC	36° 15' 37.5" N	76° 10' 29.8" W	15102	20672	12
EFD	Ellington Field	Houston, TX	29° 36' 25.6" N	95° 09' 31" W	11944	13876	34
EGE	Eagle County Regional	Eagle, CO	39° 38' 37" N	106° 54' 50" W	16774	10260	6538
EKO	Elko Muni-J.C. Harris Field	Elko, NV	40° 49' 30.5" N	115° 47' 25.2" W	17968	7532	5135
ELP	El Paso Intl	El Paso, TX	31° 48' 23.7" N	106° 22' 38.2" W	13414	9811	3956
EMM	Kemmerer Muni	Kemmerer, WY	41° 49' 30" N	110° 33' 30" W	17946	9288	7282
ENV	Wendover	Wendover, UT	40° 43' 04" N	114° 01' 50" W	17764	8074	4240
EPH	Ephrata Muni	Ephrata, WA	47° 18' 19.9" N	119° 30' 43" W	20998	7281	1272
EVV	Evansville Regional	Evansville, IN	38° 02' 16.6" N	87° 31' 50.2" W	15535	16703	418
EVW	Evanston-Uinta County Burns Field	Evanston, WY	41° 16' 30" N	111° 01' 53" W	17751	9084	7163
EWK	Newton-City-County	Newton, KS	38° 03' 26" N	97° 16' 30" W	15650	13384	1533
EWR	Newark Intl	Newark, NJ	40° 41' 34.4" N	74° 10' 08" W	17096	21044	18
F39	Grayson County	Sherman/ Denison, TX	33° 42' 54" N	96° 40' 15" W	13764	13442	749
FAR	Hector Intl	Fargo, ND	46° 54' 55.2" N	96° 48' 52" W	19457	13849	900
FAT	Fresno Air Terminal	Fresno, CA	36° 46' 34.4" N	119° 43' 01.8" W	16711	5736	332
FAY	Fayetteville Regional/ Grannis Field	Fayetteville, NC	34° 59' 28.7" N	78° 52' 48.9" W	14434	19799	190
FCA	Glacier Park Intl	Kalispell, MT	48° 18' 42.6" N	114° 15' 14.8" W	20958	8890	2972

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
FLL	Fort Lauderdale/ Hollywood Intl	Fort Lauderdale, FL	26° 04' 19.3" N	80° 09' 12.8" W	10518	19748	11
FNL	Fort Collins-Loveland Muni	Fort Collins/ Loveland, CO	40° 26' 55.4" N	105° 00' 38" W	17002	10944	5016
FNT	Bishop Intl	Flint, MI	42° 57' 55.7" N	83° 44' 36.6" W	17712	17859	782
FOE	Forbes Field	Topeka, KS	38° 57' 01.4" N	95° 39' 49.9" W	15992	13958	1080
FOK	Suffolk County	Westhampton Beach, NY	40° 50' 36.8" N	72° 37' 56.1" W	17249	21529	67
FSD	Joe Foss Field	Sioux Falls, SD	43° 34' 53" N	96° 44' 29" W	18011	13755	1429
FSM	Fort Smith Muni	Fort Smith, AR	35° 20' 11.4" N	94° 22' 02" W	14409	14310	469
FST	Fort Stockton-Pecos County	Fort Stockton, TX	30° 54' 52.9" N	102° 54' 39.8" W	12817	11021	3010
FTG	Front Range	Denver, CO	39° 47' 33.1" N	104° 33' 22.5" W	16698	11045	5485
FTW	Fort Worth Meacham	Fort Worth, TX	32° 49' 09.1" N	97° 21' 41.3" W	13398	13159	710
FWA	Fort Wayne Muni/ Baer Field	Fort Wayne, IN	40° 58' 40" N	85° 11' 38.3" W	16829	17440	815
GBD	Great Bend Muni	Great Bend, KS	38° 20' 39.9" N	98° 51' 31.7" W	15824	12859	1891
GCC	Gillette-Campbell County	Gillette, WY	44° 20' 56.1" N	105° 32' 19.7" W	18692	11068	4363
GCN	Grand Canyon National Park	Grand Canyon, AZ	35° 57' 08.5" N	112° 08' 46.5" W	15614	8165	6606
GEG	Spokane Intl	Spokane, WA	47° 37' 11.9" N	117° 31' 58.1" W	20944	7881	2372
GFK	Grand Forks-Mark Andrews Intl	Grand Forks, ND	47° 56' 57.2" N	97° 10' 33.9" W	19916	13779	844
GGG	Gregg County	Longview, TX	32° 23' 04.9" N	94° 42' 41.4" W	13140	14116	365
GJT	Walker Field	Grand Junction, CO	39° 07' 20.7" N	108° 31' 33.9" W	16662	9687	4858
GLH	Greenville Muni	Greenville, MS	33° 28' 58" N	90° 59' 07.8" W	13565	15493	131
GNV	Gainesville Regional	Gainesville, FL	29° 41' 23.3" N	82° 16' 19" W	12023	18782	152
GPT	Gulfport-Biloxi Regional	Gulfport, MS	30° 24' 25.5" N	89° 04' 12.2" W	12226	16195	28
GRB	Austin Straubel Field	Green Bay, WI	44° 29' 06.4" N	88° 07' 43.4" W	18315	16457	695
GRI	Central Nebraska Regional	Grand Island, NE	40° 58' 02.9" N	98° 18' 29.8" W	16930	13155	1846
GRR	Kent County Intl	Grand Rapids, MI	42° 52' 57.4" N	85° 31' 26.2" W	17646	17296	794
GSG	Valley County Enterprise	Glasgow, MT	48° 25' 15.9" N	106° 31' 37.6" W	20491	11096	2762
GSO	Piedmont Triad Intl	Greensboro, NC	36° 05' 51.4" N	79° 56' 15.1" W	14867	19375	926
GSP	Greenville-Spartanburg	Greer, SC	34° 53' 56.3" N	82° 12' 50.1" W	14277	18623	972
GTF	Great Falls Intl	Great Falls, MT	47° 28' 55.4" N	111° 22' 11.6" W	20392	9619	3674
GUC	Gunnison County	Gunnison, CO	38° 32' 02.3" N	106° 55' 57.3" W	16307	10163	7673
GVT	Majors	Greenville, TX	33° 04' 04" N	96° 03' 54.3" W	13468	13640	534
GVW	Richards-Gebaur	Kansas City, MO	38° 50' 38.5" N	94° 33' 36.5" W	15923	14326	1090
GYR	Phoenix-Goodyear Municipal	Goodyear, AZ	33° 25' 22" N	112° 22' 31" W	14575	7815	968
GYY	Gary Regional	Gary, IN	41° 36' 58.5" N	87° 24' 45.9" W	17079	16708	591
HBB	Industrial Airpark	Hobbs, NM	32° 46' 00" N	103° 12' 30" W	13629	11032	3707
HDN	Yampa Valley	Hayden, CO	40° 28' 52.3" N	107° 13' 01.4" W	17148	10231	6602
HLN	Helena Regional	Helena, MT	46° 36' 24.6" N	111° 58' 54.8" W	20065	9349	3873
HOB	Lea County/Hobbs	Hobbs, NM	32° 41' 14.6" N	103° 12' 59.5" W	13595	11024	3659
HON	Huron Regional	Huron, SD	44° 23' 07.3" N	98° 13' 43.5" W	18399	13322	1288
HOU	William P. Hobby	Houston, TX	29° 38' 42.7" N	95° 16' 43.2" W	11964	13832	47
HRL	Rio Grande Valley Intl	Harlingen, TX	26° 13' 41.4" N	97° 39' 14.8" W	10541	12795	36
HSV	Huntsville Intl-Carl T. Jones Field	Huntsville, AL	34° 38' 28.2" N	86° 46' 26.5" W	14077	17005	629

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
HUF	Hulman Regional	Terre Haute, IN	39° 27' 06.6" N	87° 18' 32" W	16147	16764	585
HUT	Hutchinson Muni	Hutchinson, KS	38° 03' 55.7" N	97° 51' 37.1" W	15671	13186	1542
HYA	Barnstable Muni-Boardman/Polando Field	Hyannis, MA	41° 40' 07.2" N	70° 16' 48.2" W	17749	22210	52
IAG	Niagara Falls Intl	Niagara Falls, NY	43° 06' 26" N	78° 56' 45" W	17910	19370	590
ICT	Wichita Mid-Continent	Wichita, KS	37° 38' 59.8" N	97° 25' 57.8" W	15479	13315	1332
IDA	Fanning Field	Idaho Falls, ID	43° 30' 59.3" N	112° 04' 01.9" W	18771	8995	4740
IDL	Indianola Muni	Indianola, MS	33° 29' 08.2" N	90° 40' 43.6" W	13565	15605	126
ILG	New Castle County	Wilmington, DE	39° 40' 42.4" N	75° 36' 24.6" W	16588	20644	80
ILM	New Hanover County	Wilmington, NC	34° 16' 13.6" N	77° 54' 10.3" W	14167	20183	32
ILN	Airborne Airpark	Wilmington, OH	39° 25' 44.8" N	83° 47' 58.9" W	16188	17937	1071
IND	Indianapolis Intl	Indianapolis, IN	39° 43' 31.9" N	86° 17' 01.9" W	16275	17102	797
INW	Winslow Muni	Winslow, AZ	35° 01' 18.1" N	110° 43' 26.2" W	15103	8557	4938
IXD	Johnson Co. Industrial	Olathe, KS	38° 49' 54.3" N	94° 53' 22.7" W	15924	14215	1087
IYK	Inyokern	Inyokern, CA	35° 39' 32" N	117° 49' 43" W	16045	6210	2457
JAN	Jackson Intl	Jackson, MS	32° 18' 39.7" N	90° 04' 32.9" W	13054	15820	346
JAX	Jacksonville Intl	Jacksonville, FL	30° 29' 33" N	81° 41' 23.7" W	12390	18972	30
LAN	Capital City	Lansing, MI	42° 46' 43.2" N	84° 35' 14.6" W	17616	17596	861
LAR	General Brees Field	Laramie, WY	41° 18' 45.2" N	105° 40' 25.6" W	17407	10794	7278
LAW	Lawton Muni	Lawton, OK	34° 34' 03.5" N	98° 24' 58.7" W	14186	12849	1110
LBB	Lubbock Intl	Lubbock, TX	33° 39' 48.9" N	101° 49' 20.4" W	13941	11587	3281
LBE	Westmoreland County	Latrobe, PA	40° 16' 33.1" N	79° 24' 18.2" W	16677	19361	1185
LBF	Lee Bird Field	North Platte, NE	41° 07' 33.6" N	100° 41' 12.5" W	17084	12390	2778
LBL	Liberal Muni	Liberal, KS	37° 02' 37.3" N	100° 57' 38.8" W	15349	12079	2887
LCK	Rickenbacker ANGB	Columbus, OH	39° 48' 49.3" N	82° 55' 40.7" W	16373	18216	744
LEX	Blue Grass	Lexington, KY	38° 02' 12.8" N	84° 36' 19.6" W	15573	17700	980
LFT	Lafayette Regional	Lafayette, LA	30° 12' 18.2" N	91° 59' 15.1" W	12151	15091	0
LGA	La Guardia	New York, NY	40° 46' 37.7" N	73° 52' 22.9" W	17148	21133	22
LGB	Long Beach/ Daugherty Field	Long Beach, CA	33° 49' 03.7" N	118° 09' 02.6" W	15324	5855	57
LHX	La Junta Muni	La Junta, CO	38° 03' 04.8" N	103° 30' 36.7" W	15901	11273	4238
LIT	Adams Field	Little Rock, AR	34° 43' 48.3" N	92° 13' 58.8" W	14115	15057	258
LMT	Klamath Falls Intl	Klamath Falls, OR	42° 09' 22.6" N	121° 43' 55.5" W	19123	5884	4092
LNK	Lincoln Muni	Lincoln, NE	40° 51' 02.8" N	96° 45' 32.1" W	16835	13656	1214
LRD	Laredo Intl	Laredo, TX	27° 32' 39.5" N	99° 27' 39.7" W	11188	12143	508
LRU	Las Cruces Intl	Las Cruces, NM	32° 17' 21.6" N	106° 55' 17" W	13657	9653	4454
LSE	La Crosse Muni	La Crosse, WI	43° 52' 45" N	91° 15' 22.4" W	18055	15482	654
LVS	Las Vegas Muni	Las Vegas, NM	35° 39' 15" N	105° 08' 30.7" W	14973	10547	6874
LWB	Greenbrier Valley	Lewisburg, WV	37° 51' 29.5" N	80° 23' 58.9" W	15606	19138	2303
MAF	Midland Intl	Midland, TX	31° 56' 33" N	102° 12' 06.3" W	13221	11347	2871
MBS	Tri-City Intl	Saginaw, MI	43° 31' 59.2" N	84° 04' 46.8" W	17951	17738	668
MCO	Orlando Intl	Orlando, FL	28° 25' 43" N	81° 18' 58.4" W	11505	19194	96
MDT	Harrisburg Intl Airport-Olmsted Field	Middletown, PA	40° 11' 36" N	76° 45' 49" W	16752	20232	310
MDW	Chicago Midway	Chicago, IL	41° 47' 09.9" N	87° 45' 07.9" W	17150	16596	619
MEI	Key Field	Meridian, MS	32° 19' 58.8" N	88° 45' 04.2" W	13064	16308	297
MEM	Memphis Intl	Memphis, TN	35° 02' 59.2" N	89° 58' 43.4" W	14239	15862	332
MEV	Douglas County	Minden, NV	39° 00' 02" N	119° 45' 07" W	17621	6038	4718
MFD	Mansfield Lahm Muni	Mansfield, OH	40° 49' 16.9" N	82° 31' 00.3" W	16816	18319	1297
MFE	Miller Intl	McAllen, TX	26° 10' 31.4" N	98° 14' 17.7" W	10540	12561	107
MGM	Dannelly Field	Montgomery, AL	32° 18' 01.8" N	86° 23' 38.5" W	13068	17175	221

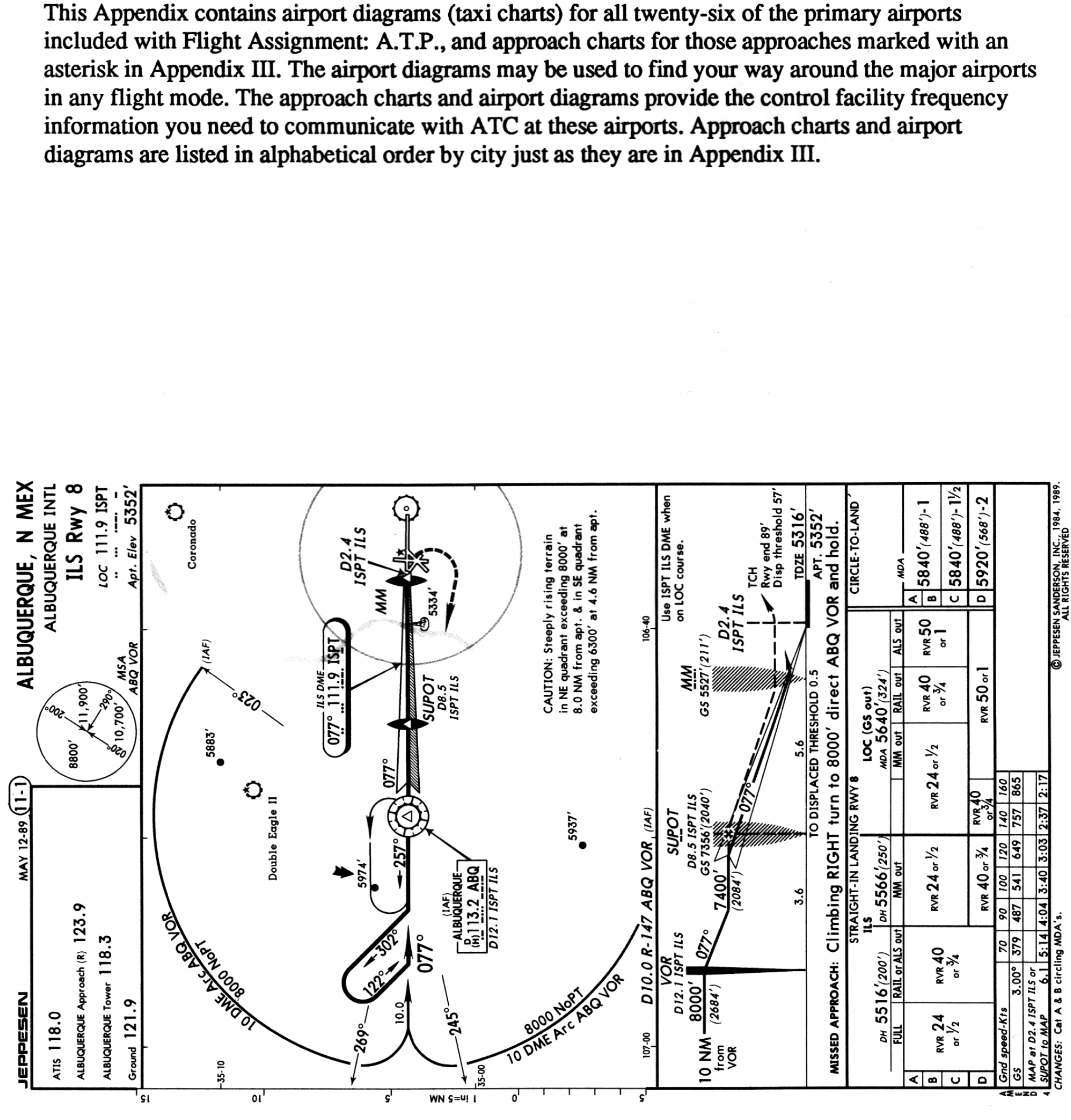
Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
MHK	Manhattan Muni	Manhattan, KS	39° 08' 27.5" N	96° 40' 14" W	16099	13626	1056
MHT	Grenier Industrial Park	Manchester, NH	42° 56' 00.4" N	71° 26' 17.5" W	18209	21735	234
MHV	Mojave	Mojave, CA	35° 03' 30" N	118° 09' 00" W	15833	6022	2787
MKC	Kansas City Downtown	Kansas City, MO	39° 07' 23.7" N	94° 35' 33" W	16044	14322	758
MKE	General Mitchell Intl	Milwaukee, WI	42° 56' 48.4" N	87° 53' 48.9" W	17651	16541	723
MKO	Davis Field	Muskogee, OK	35° 39' 30" N	95° 21' 45" W	14568	13968	610
MLB	Melbourne Regional	Melbourne, FL	28° 06' 08.9" N	80° 38' 45.7" W	11387	19466	35
MLI	Quad-City	Moline, IL	41° 26' 55.4" N	90° 30' 23.6" W	17000	15705	589
MLU	Monroe Regional	Monroe, LA	32° 30' 38.6" N	92° 02' 15.2" W	13153	15100	79
MMH	Mammoth-June Lakes	Mammoth Lakes, CA	37° 37' 26.8" N	118° 50' 16" W	16959	6141	7128
MOB	Bates Field	Mobile, AL	30° 41' 28.4" N	88° 14' 34.1" W	12353	16504	218
MOT	Minot Intl	Minot, ND	48° 15' 34" N	101° 16' 50.9" W	20179	12598	1715
MQY	Smyrna	Smyrna, TN	36° 00' 32.1" N	86° 31' 12.3" W	14670	17076	543
MRB	Eastern WV Regional/Shepherd	Martinsburg, WV	39° 24' 06.6" N	77° 59' 05.5" W	16360	19874	557
MSN	Dane County Regional-Truax Field	Madison, WI	43° 08' 22.1" N	89° 20' 13.1" W	17729	16084	862
MSO	Missoula Intl	Missoula, MT	46° 54' 59" N	114° 05' 22.6" W	20358	8774	3201
MTJ	Montrose County	Montrose, CO	38° 30' 00.8" N	107° 53' 39.1" W	16356	9841	5759
MTN	Martin State	Baltimore, MD	39° 19' 40" N	76° 24' 57" W	16399	20400	34
MWH	Grant County	Moses Lake, WA	47° 12' 28.1" N	119° 19' 08.5" W	20939	7322	1185
O01	Santa Rosa Air Center	Santa Rosa, CA	38° 24' 52" N	122° 45' 25" W	17731	4998	100
OAJ	Albert J Ellis	Jacksonville, NC	34° 49' 44.4" N	77° 36' 44.8" W	14420	20255	94
OAK	Metropolitan Oakland Intl	Oakland, CA	37° 43' 16.9" N	122° 13' 10.7" W	17387	5063	6
OGD	Ogden-Hinckley	Ogden, UT	41° 11' 45.8" N	112° 00' 40.7" W	17794	8766	4470
OKC	Will Rogers World	Oklahoma City, OK	35° 23' 34.9" N	97° 36' 01.5" W	14514	13171	1295
OMA	Eppley Airfield	Omaha, NE	41° 18' 07.5" N	95° 53' 36.1" W	17008	13952	983
ONT	Ontario Intl	Ontario, CA	34° 03' 21.6" N	117° 36' 01.1" W	15361	6076	943
OPF	Opa Locka	Miami, FL	25° 54' 24.8" N	80° 16' 48.6" W	10441	19705	9
OQU	Quonset State	North Kingstown, RI	41° 35' 48" N	71° 24' 45" W	17644	21857	19
ORF	Norfolk Intl	Norfolk, VA	36° 53' 40" N	76° 12' 06" W	15371	20623	27
OSH	Wittman Regional	Oshkosh, WI	43° 59' 03.8" N	88° 33' 24.8" W	18097	16327	808
P34	Window Rock	Window Rock, AZ	35° 39' 07.4" N	109° 04' 00.2" W	15238	9189	6739
PAE	Snohomish County (Paine Field)	Everett, WA	47° 54' 28" N	122° 16' 49" W	21522	6600	606
PBI	Palm Beach Intl	West Palm Beach, FL	26° 40' 58.4" N	80° 05' 45" W	10788	19743	19
PDX	Portland Intl	Portland, OR	45° 35' 19.9" N	122° 35' 46.7" W	20611	6153	27
PHF	Patrick Henry Intl	Newport News, VA	37° 07' 54.3" N	76° 29' 35.9" W	15458	20509	43
PIA	Greater Peoria	Peoria, IL	40° 39' 52.9" N	89° 41' 29.9" W	16660	15969	660
PIE	St. Petersburg/ Clearwater Intl	St. Petersburg/ Clearwater, FL	27° 54' 37.6" N	82° 41' 15.4" W	11235	18682	11
PIH	Pocatello Muni	Pocatello, ID	42° 54' 47.5" N	112° 35' 39.2" W	18560	8768	4449
PNA	Ralph Wenz Field	Pinedale, WY	42° 47' 44" N	109° 48' 23" W	18300	9618	7085
PNE	Northeast Philadelphia	Philadelphia, PA	40° 04' 54.6" N	75° 00' 39.5" W	16791	20813	121
PNS	Pensacola Regional	Pensacola, FL	30° 28' 23.2" N	87° 11' 15" W	12266	16903	121
PQI	Northern Maine Regional	Presque Isle, ME	46° 41' 20.1" N	68° 02' 43.2" W	20026	22406	534
PRC	Ernest A. Love Field	Prescott, AZ	34° 39' 05.7" N	112° 25' 14.5" W	15094	7932	5042
PSC	Tri-Cities	Pasco, WA	46° 15' 53.4" N	119° 07' 04.5" W	20530	7247	407
PSP	Palm Springs Regional	Palm Springs, CA	33° 49' 41" N	116° 30' 19" W	15149	6423	462
PUB	Pueblo Memorial	Pueblo, CO	38° 17' 20.7" N	104° 29' 45.8" W	16056	10958	4726

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
PUC	Carbon County	Price, UT	39° 36' 43" N	110° 44' 59" W	17031	9007	5921
PVD	Theodore Francis Green State	Providence, RI	41° 43' 29.7" N	71° 25' 42.1" W	17697	21841	55
PVU	Provo Muni	Provo, UT	40° 12' 56.4" N	111° 43' 14.6" W	17361	8755	4491
PWA	Wiley Post	Oklahoma City, OK	35° 32' 03.4" N	97° 38' 48.5" W	14577	13160	1299
PWM	Portland Intl Jetport	Portland, ME	43° 38' 45.9" N	70° 18' 33.3" W	18584	22021	74
RAP	Rapid City Regional	Rapid City, SD	44° 02' 43.2" N	103° 03' 24.9" W	18437	11811	3202
RDD	Redding Muni	Redding, CA	40° 30' 32.8" N	122° 17' 32.2" W	18521	5464	502
RDM	Roberts Field	Redmond, OR	44° 15' 15.2" N	121° 08' 55.8" W	19912	6370	3077
RDU	Raleigh-Durham Intl	Raleigh/Durham, NC	35° 52' 38.8" N	78° 47' 15.3" W	14818	19787	437
RFD	Greater Rockford	Rockford, IL	42° 11' 46.4" N	89° 05' 33.4" W	17322	16163	736
RIC	Richmond Intl (Byrd Field)	Richmond, VA	37° 30' 18.1" N	77° 19' 11.9" W	15578	20204	168
RIW	Riverton Regional	Riverton, WY	43° 03' 53.9" N	108° 27' 28.4" W	18322	10062	5525
RKS	Rock Springs-Sweetwater County	Rock Springs, WY	41° 35' 39" N	109° 03' 52" W	17742	9738	6760
RNO	Reno Cannon Intl	Reno, NV	39° 29' 56.7" N	119° 46' 01.9" W	17826	6104	4412
ROC	Greater Rochester Intl	Rochester, NY	43° 07' 07.7" N	77° 40' 21.6" W	17964	19770	559
ROW	Roswell Industrial Air Center	Roswell, NM	33° 18' 05.2" N	104° 31' 48.1" W	13933	10592	3669
RST	Rochester Muni	Rochester, MN	43° 54' 31.9" N	92° 29' 52.1" W	18078	15094	1317
RSW	Southwest Florida Regional	Fort Myers, FL	26° 32' 10" N	81° 45' 17.5" W	10662	19095	31
RWL	Rawlins Muni	Rawlins, WY	41° 48' 20.3" N	107° 11' 57.6" W	17708	10348	6813
S33	City-County	Madras, OR	44° 39' 59" N	121° 09' 43" W	20081	6427	2434
SAA	Shively Field	Saratoga, WY	41° 26' 40" N	106° 49' 25" W	17532	10437	6978
SAF	Santa Fe County Muni	Santa Fe, NM	35° 37' 01.4" N	106° 05' 19.9" W	15016	10215	6344
SAT	San Antonio Intl	San Antonio, TX	29° 32' 00.4" N	98° 28' 10.1" W	12014	12615	809
SAV	Savannah Intl	Savannah, GA	32° 07' 38.5" N	81° 12' 09.3" W	13113	19091	51
SBN	Michiana Regional	South Bend, IN	41° 42' 17.2" N	86° 19' 00.3" W	17127	17062	790
SCH	Schenectady County	Schenectady, NY	42° 51' 09.5" N	73° 55' 48" W	18029	20962	378
SCK	Stockton Metropolitan	Stockton, CA	37° 53' 39.3" N	121° 14' 13.8" W	17340	5404	30
SDF	Standiford Field	Louisville, KY	38° 10' 29" N	85° 44' 11" W	15614	17312	496
SDL	Scottsdale Muni	Scottsdale, AZ	33° 37' 22.2" N	111° 54' 35.4" W	14617	8000	1508
SDM	Brown Field Muni	San Diego, CA	32° 34' 19.9" N	116° 58' 45.7" W	14680	6098	524
SEM	Craig Field	Selma, AL	32° 20' 37.7" N	86° 59' 16.1" W	13080	16956	166
SFB	Central Florida Regional	Sanford, FL	28° 46' 43" N	81° 14' 17.4" W	11660	19210	55
SGF	Springfield Regional	Springfield, MO	37° 14' 39.4" N	93° 23' 12" W	15214	14692	1267
SGH	Springfield-Beckley Muni	Springfield, OH	39° 50' 24.8" N	83° 50' 24.8" W	16364	17912	1052
SGR	Houston-Hull	Houston, TX	29° 37' 19.3" N	95° 39' 22.7" W	11963	13687	83
SHV	Shreveport Regional	Shreveport, LA	32° 26' 47.3" N	93° 49' 31.5" W	13150	14442	258
SIY	Siskiyou County	Montague, CA	41° 46' 53.7" N	122° 28' 01.1" W	19055	5605	2648
SJC	San Jose Intl	San Jose, CA	37° 21' 41.9" N	121° 55' 39.4" W	17207	5102	56
SLN	Salina Muni	Salina, KS	38° 47' 29.7" N	97° 39' 02.3" W	15976	13285	1272
SMF	Sacramento Metropolitan	Sacramento, CA	38° 41' 44" N	121° 36' 01" W	17707	5407	23
SNA	John Wayne Airport-Orange County	Santa Ana, CA	33° 40' 32.3" N	117° 52' 02.4" W	15234	5934	54
SPI	Capital	Springfield, IL	39° 50' 37.3" N	89° 40' 37.6" W	16307	15973	597
SRQ	Sarasota-Bradenton	Sarasota/ Bradenton, FL	27° 23' 42.1" N	82° 33' 15.4" W	11013	18751	28
SRR	Sierra Blanca Regional	Ruidoso, NM	33° 27' 46" N	105° 32' 03" W	14064	10244	6811

Ident.	Airport	Location	Latitude	Longitude	North	East	Elev.
STJ	Rosecrans Memorial	St. Joseph, MO	39° 46' 16.7" N	94° 54' 37.3" W	16329	14232	826
SUS	Spirit Of St. Louis	St. Louis, MO	38° 39' 43.2" N	90° 39' 00.1" W	15800	15643	463
SUX	Sioux Gateway	Sioux City, IA	42° 24' 13.7" N	96° 23' 00.1" W	17495	13829	1098
SWF	Stewart Intl	Newburgh, NY	41° 30' 14.4" N	74° 06' 18.9" W	17445	21005	491
SYR	Syracuse Hancock Intl	Syracuse, NY	43° 06' 40" N	76° 06' 24" W	18029	20262	421
T31	Port Isabel-Cameron County	Port Isabel, TX	26° 09' 56.7" N	97° 20' 44.7" W	10503	12914	19
T72	Hearne Muni	Hearne, TX	30° 52' 10" N	96° 37' 10" W	12532	13364	287
TCC	Tucumcari Muni	Tucumcari, NM	35° 10' 57.8" N	103° 36' 09.6" W	14683	11051	4064
TEB	Teterboro	Teterboro, NJ	40° 51' 00" N	74° 03' 40.5" W	17169	21067	9
TLH	Tallahassee Regional	Tallahassee, FL	30° 23' 46.8" N	84° 21' 01.6" W	12276	17974	81
TNT	Dade-Collier Training And Transition	Miami, FL	25° 51' 46" N	80° 53' 50" W	10397	19462	14
TOL	Toledo Express	Toledo, OH	41° 35' 14.5" N	83° 48' 19" W	17116	17877	684
TPH	Tonopah	Tonopah, NV	38° 03' 29.2" N	117° 05' 18.9" W	16953	6768	5426
TRI	Tri-City Regional	TN	36° 28' 30.4" N	82° 24' 27.2" W	14950	18501	1519
TUL	Tulsa Intl	Tulsa, OK	36° 11' 53.8" N	95° 53' 16.7" W	14813	13799	677
TUS	Tucson Intl	Tucson, AZ	32° 06' 58.2" N	110° 56' 26.2" W	13898	8188	2641
TVL	Lake Tahoe	South Lake Tahoe, CA	38° 53' 38.3" N	119° 59' 39.6" W	17605	5946	6264
TWF	Sun Valley Regional (Joslin Field)	Twin Falls, ID	42° 28' 54.8" N	114° 29' 12.7" W	18537	8137	4151
TYR	Tyler Pounds Field	Tyler, TX	32° 21' 14.6" N	95° 24' 07.9" W	13142	13861	544
TYS	McGhee Tyson	Knoxville, TN	35° 48' 45" N	83° 59' 34.3" W	14627	17967	981
UIN	Quincy Muni Baldwin Field	Quincy, IL	39° 56' 33.3" N	91° 11' 39.7" W	16355	15470	769
VCT	Victoria Regional	Victoria, TX	28° 51' 08.2" N	96° 55' 05.6" W	11664	13180	115
VNY	Van Nuys	Van Nuys, CA	34° 12' 35.3" N	118° 29' 20.6" W	15523	5792	799
VRB	Vero Beach Muni	Vero Beach, FL	27° 39' 16.4" N	80° 24' 58" W	11200	19574	25
WAL	Wallops Flight Facility	Wallops Island, VA	37° 56' 30" N	75° 27' 45" W	15856	20807	41
WRL	Worland Muni	Worland, WY	43° 57' 56.2" N	107° 56' 58.7" W	18671	10298	4245
WYS	Yellowstone	West Yellowstone, MT	44° 41' 18.5" N	111° 07' 00.7" W	19192	9405	6644
X68	NASA Shuttle Landing Facility	Titusville, FL	28° 36' 53" N	80° 41' 41" W	11608	19425	9
YIP	Willow Run	Detroit, MI	42° 14' 16.4" N	83° 31' 49.7" W	17402	17947	716
YKM	Yakima Air Terminal	Yakima, WA	46° 34' 06.1" N	120° 32' 33" W	20796	6884	1095
YNG	Youngstown Muni	Youngstown, OH	41° 15' 32.1" N	80° 40' 34.3" W	17056	18902	1196

Appendix IV. Airport Diagrams and Approach Charts

This Appendix contains airport diagrams (taxi charts) for all twenty-six of the primary airports included with Flight Assignment: A.T.P., and approach charts for those approaches marked with an asterisk in Appendix III. The airport diagrams may be used to find your way around the major airports in any flight mode. The approach charts and airport diagrams provide the control facility frequency information you need to communicate with ATC at these airports. Approach charts and airport diagrams are listed in alphabetical order by city just as they are in Appendix III.



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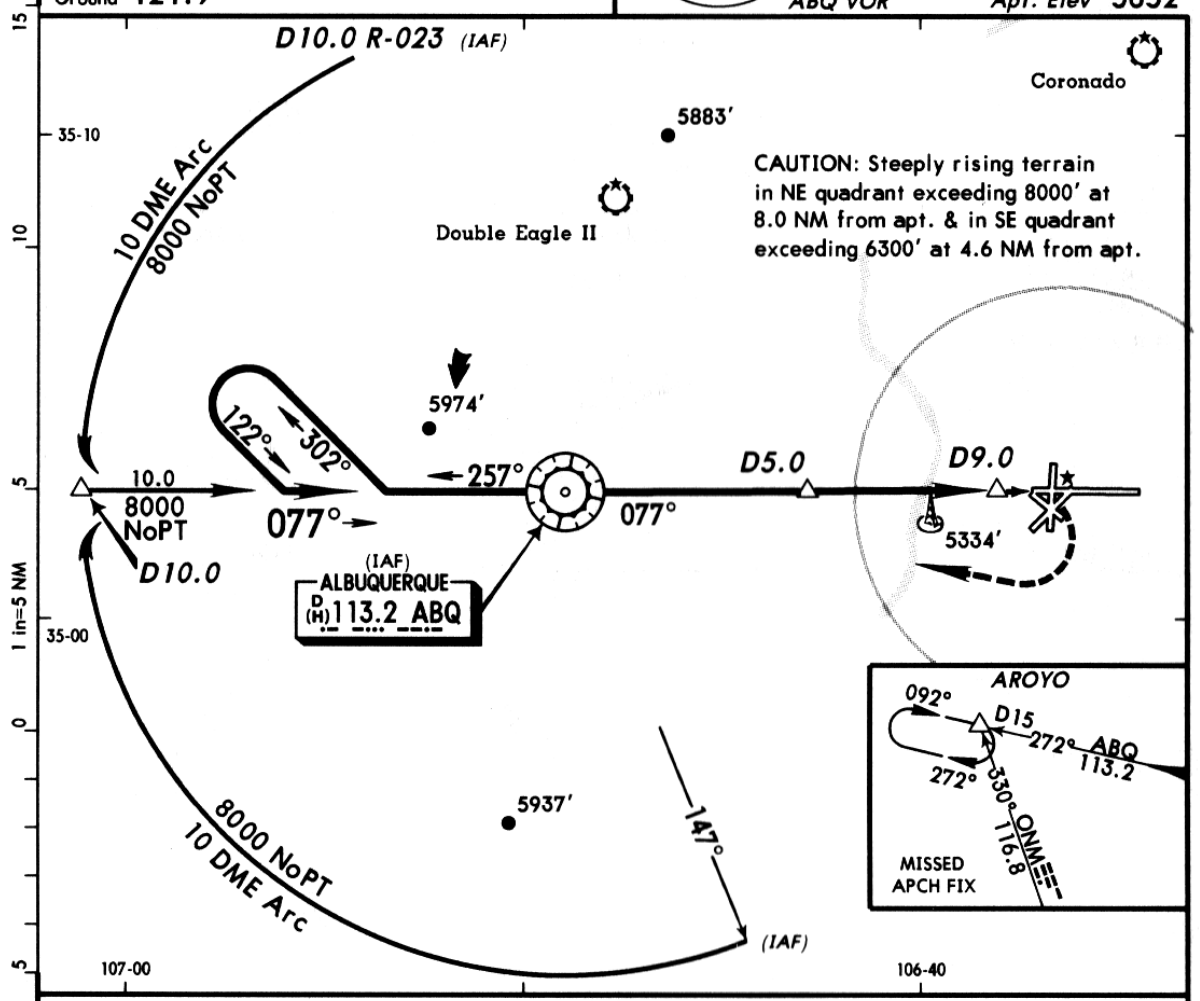
JEPPESEN MAY 12-89 (13-1)

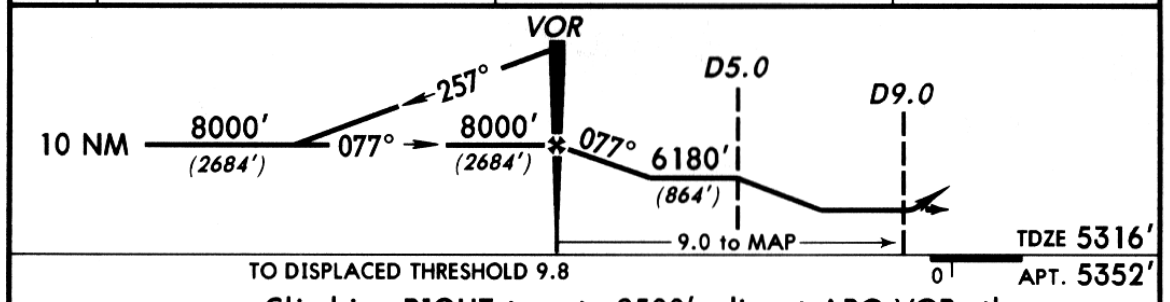
ALBUQUERQUE, N MEX
ALBUQUERQUE INTL
VOR Rwy 8

ATIS 118.0
ALBUQUERQUE Approach (R) 123.9
ALBUQUERQUE Tower 118.3
Ground 121.9

VOR 113.2 ABQ
Apt. Elev 5352'

MSA ABQ VOR
8800' 200° 11,900' 290° 020° 10,700'





MISSED APPROACH: Climbing RIGHT turn to 9500', direct ABQ VOR, then outbound via ABQ VOR R-272 to AROYO INT and hold.

STRAIGHT-IN LANDING RWY 8

	MDA 5660' (344') With D5.0	RAIL out	ALS out	MDA 6180' (864') Without D5.0	RAIL out	ALS out
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1
B				RVR 40 or 3/4	RVR 60 or 1 1/4	
C				2	2 1/2	
D	RVR 50 or 1	RVR 60 or 1 1/4		2 1/4	2 3/4	

CIRCLE-TO-LAND

	With D5.0 MDA	Without D5.0 MDA
A	5840' (488') - 1	6180' (828') - 1
B		6180' (828') - 1 1/4
C	5840' (488') - 1 1/2	6180' (828') - 2 1/2
D	5920' (568') - 2	6180' (828') - 2 3/4

Gnd speed-Kts	70	90	100	120	140	160
MAP at D9.0 or VOR to MAP 9.0	7:43	6:00	5:24	4:30	3:51	3:23

AMEND 18

CHANGES: Cat A & B circling MDA's.

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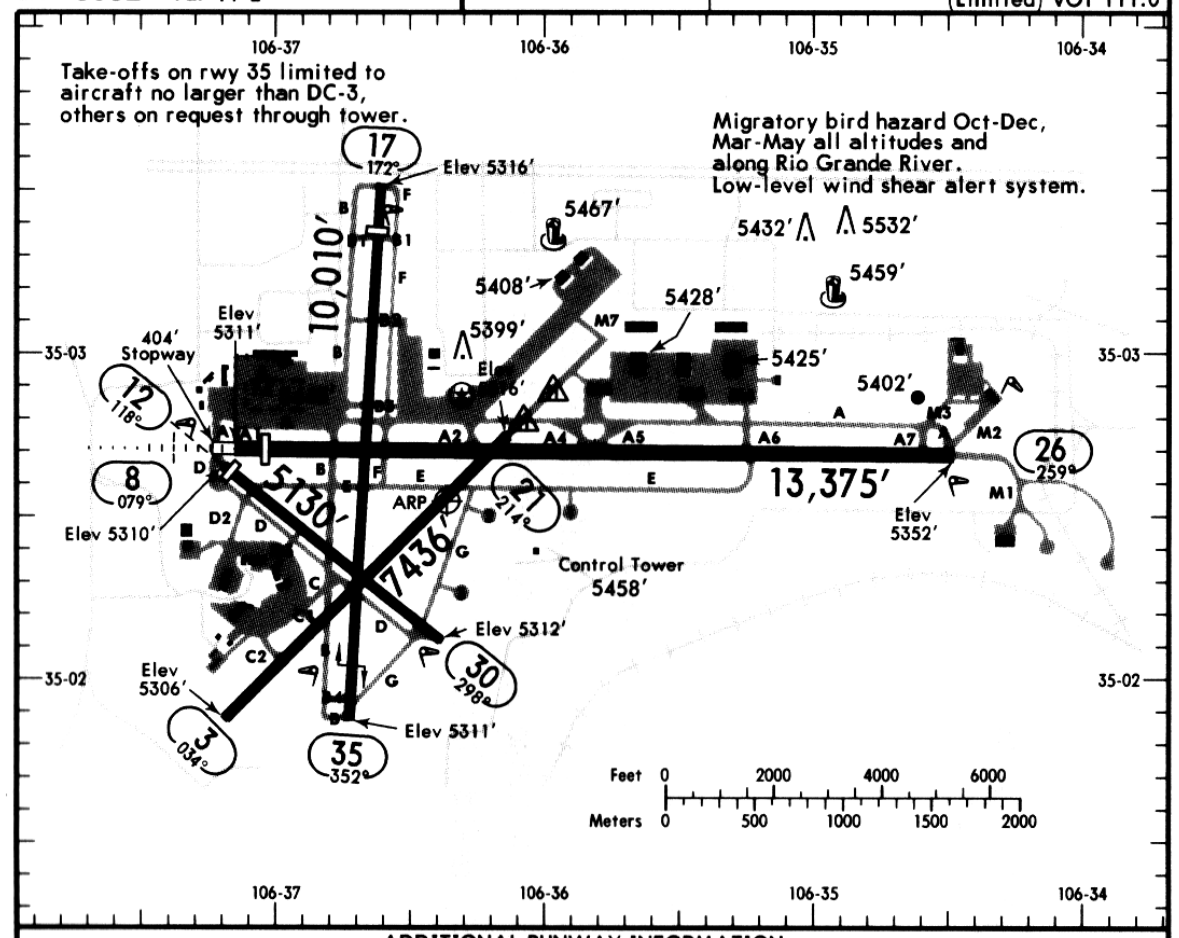
ALBUQUERQUE, N MEX KABQ
ALBUQUERQUE INTL

(11-1) MAY 12-89 JEPPESEN

N35 02.5 W106 36.4 077.5°/10.3 From ABQ 113.2
Elev 5352' Var 11°E

ATIS 118.0
ALBUQUERQUE Clearance 119.2
Ground 121.9
Tower 118.3

ALBUQUERQUE Departure (R)
127.4 (On or N of V-12 & E of Sandia mtns.)
123.9 (S of V-12 & E of Manzano mtns.)
121.1 (S of V-12 & W of Manzano mtns.)
124.4 (On or N of V-12 & W of Sandia mtns.)
(Limited) VOT 111.0



ADDITIONAL RUNWAY INFORMATION

RWY			USABLE LENGTHS LANDING BEYOND Threshold DAY | NIGHT	Glide Slope	TAKE-OFF	WIDTH
3	21	MIRL			❷	150'
8 ❶	26	HIRL MALSR VASI RVR HIRL REIL VASI (3 bar)-L	12,785'	11,710'		300'
12	30	MIRL MIRL REIL	4983'			150'
17	35	MIRL REIL VASI-L grooved MIRL VASI-L grooved	9120'			150'

❶ Grooved 130' wide.
❷ Take-off prohibited except for emergency conditions on field.

TAKE-OFF & IFR DEPARTURE PROCEDURE

	Rwys 3, 12, 17, 21, 26, 30, 35 Forward Vis Ref	STD	Rwy 8 With Min climb of 424'/NM to 8000' Forward Vis Ref	STD	Other
1 & 2 Eng	1/4	1	RVR 16 or 1/4	❶ RVR 50 or 1	2400-2
3 & 4 Eng		1/2		RVR 24 or 1/2	

FOR FILING AS ALTERNATE

	Precision	LOC Rwy 8 NDB Rwy 35 ❷ VOR Rwy 8
A	600-2	800-2
B		
C		
D		

IFR DEPARTURE PROCEDURE: Comply with SID or radar vectors, or: Rwy 8 turn left or right as cleared. All aircraft climb direct ABQ VOR. Departures on R-147 clockwise R-023 climb on course. All others climb westbound to cross ABQ VOR at or above 10000'.

❶ FAR 135: Rwy 8, RVR 24.
❷ Without DME 900-3.

AMEND 3

CHANGES: Airport note.

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JEPPESEN MAR 4-88 (11-3A) Eff Mar 10

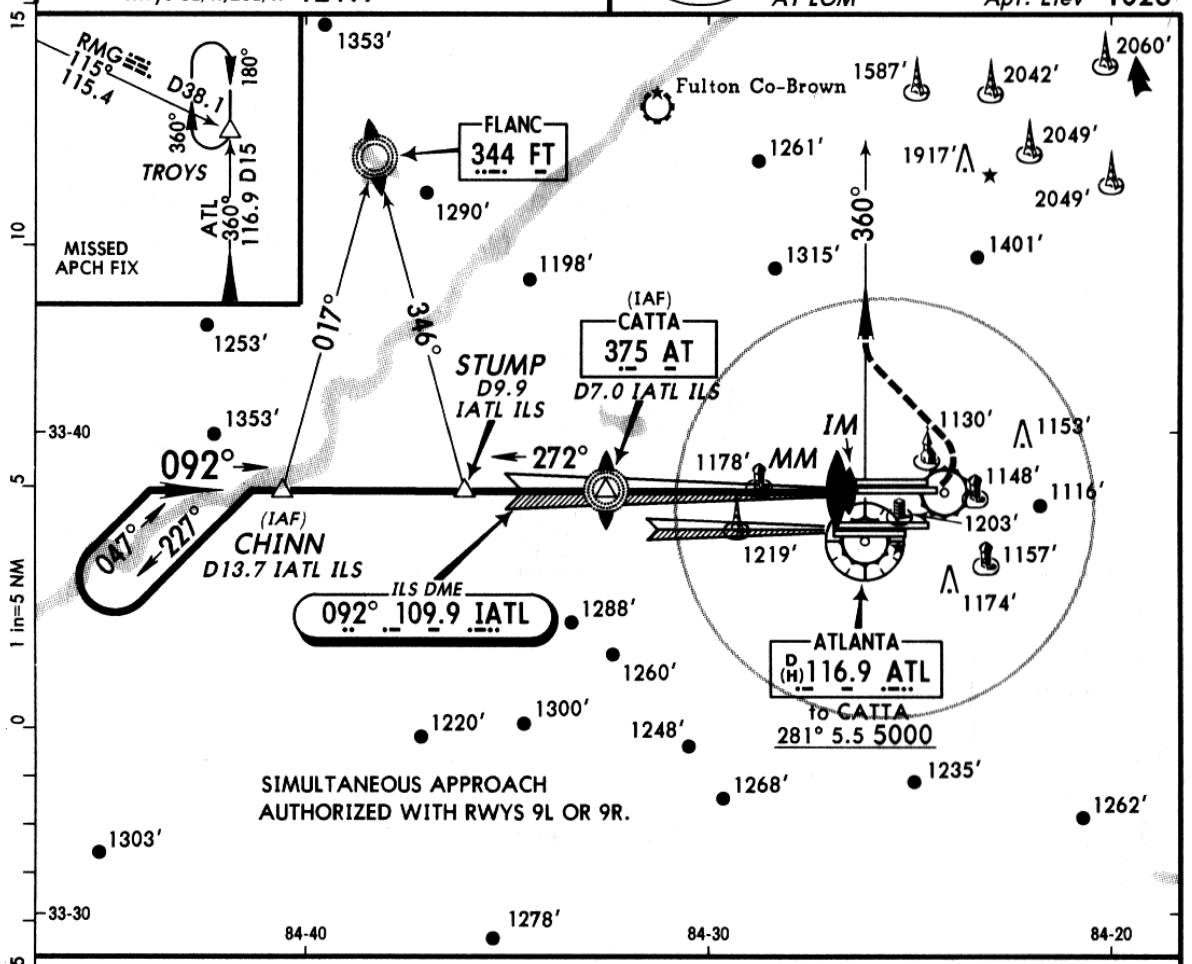
ATLANTA, GA
THE HARTSFIELD ATLANTA INTL
ILS Rwy 8R CAT II

Special Aircrew & Acft Certification Required

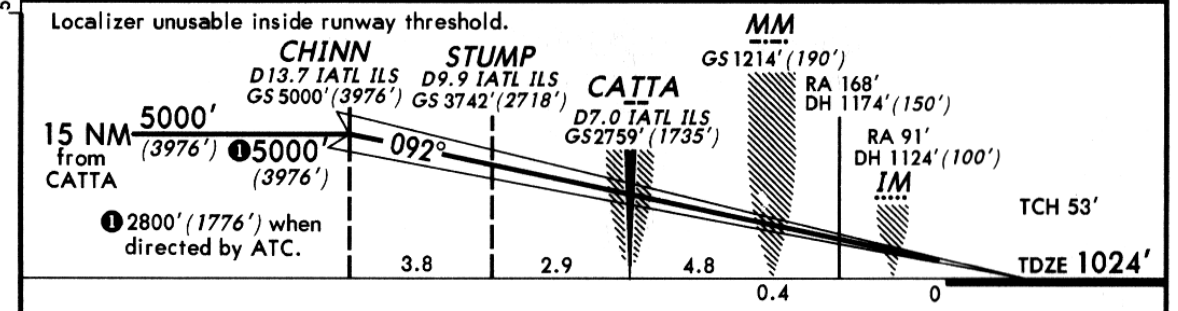
LOC 109.9 IATL

Apt. Elev 1026′

ATIS Arrival 119.65
ATLANTA Approach (R) 127.9
ATLANTA Tower Rwys 9L/R,27L/R 119.1
Rwys 8L/R,26L/R 119.5
Ground Rwys 9L/R,27L/R 121.75
Rwys 8L/R,26L/R 121.9



Localizer unusable inside runway threshold.



MISSED APPROACH: Climb to 1500′, then climbing LEFT turn to 3500′ outbound via ATL VOR R-360 to TROYS INT/D15.0 ATL and hold.

STRAIGHT-IN LANDING RWY **8R**
CAT II ILS

RA 91′ DH 1124′ (100′)	RA 168′ DH 1174′ (150′)
RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862

AMEND 58

CHANGES: Chart reindexed.

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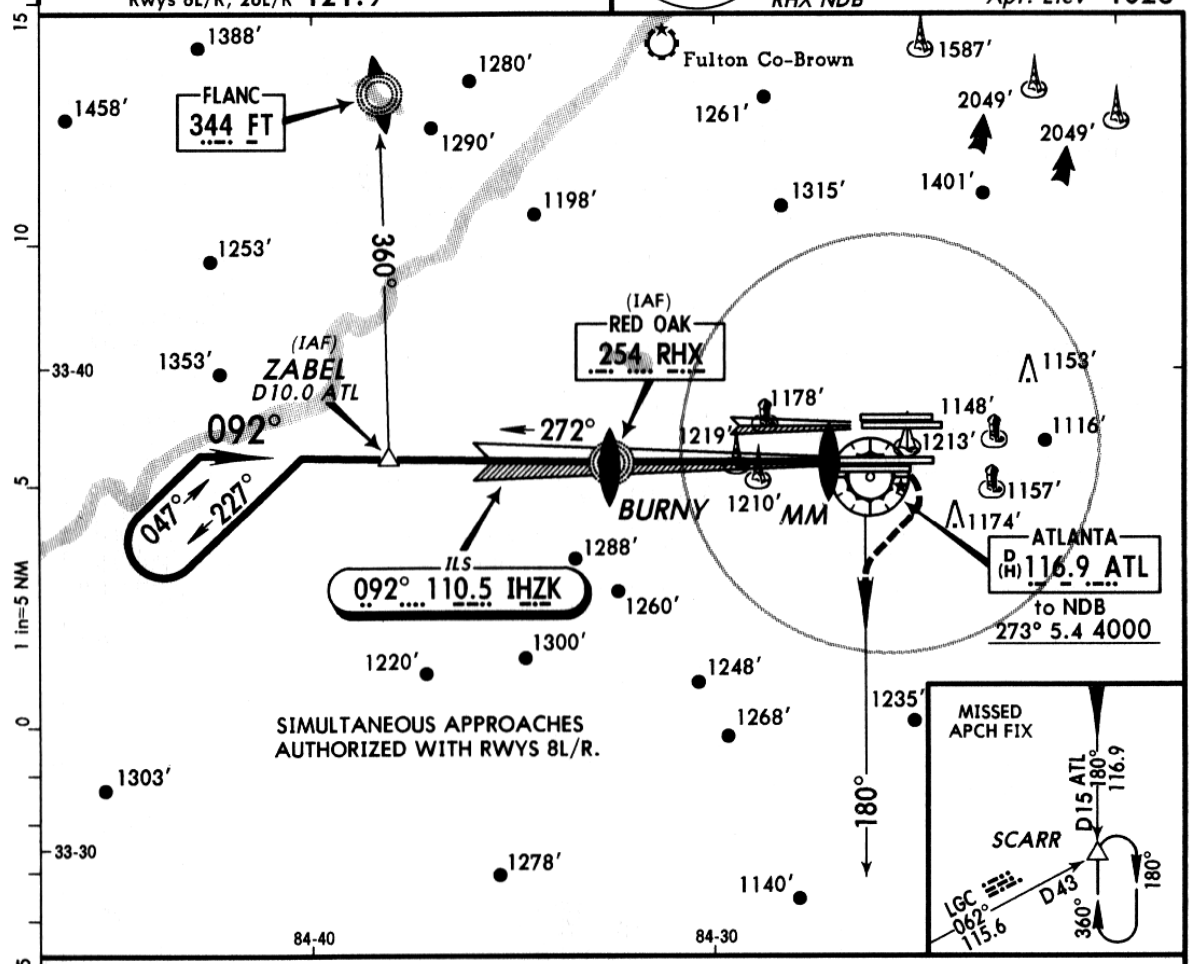
JEPPESEN JAN 8-88 (11-7)

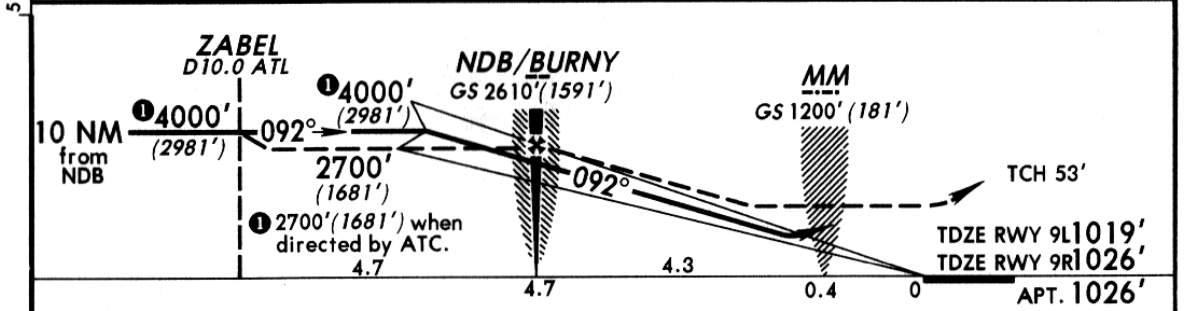
ATLANTA, GA
THE HARTSFIELD ATLANTA INTL
ILS Rwy 9L

LOC 110.5 IHZK

Apt. Elev 1026′

ATIS Arrival 119.65
ATLANTA Approach (R) 127.9
ATLANTA Tower Rwys 9L/R, 27L/R 119.1
Rwys 8L/R, 26L/R 119.5
Ground Rwys 9L/R, 27L/R 121.75
Rwys 8L/R, 26L/R 121.9





MISSED APPROACH: Climb to 1500′ then climbing RIGHT turn to 3500′ via outbound ATL VOR R-180 to SCARR INT/D15.0 ATL VOR and hold.

STRAIGHT-IN LANDING RWY **9L**

	ILS			LOC (GS out)			SIDESTEP LANDING RWY 9R	
	DH 1219′ (200′)		DH 1269′ (250′)	MDA 1480′ (461′)			MDA 1480′ (454′)	
	FULL	RAIL or ALS out	MM out		RAIL out	ALS out		ALS out
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	RVR 50 or 1	
B								
C				RVR 40 or 3/4	RVR 60 or 1 1/4		RVR 50 or 1	1 1/2
D			RVR 40 or 3/4	RVR 50 or 1	1 1/2		1 1/2	2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	646	754	862
NDB/OM to MAP	4.7	4:02	3:08	2:49	2:21	2:01	1:46

AMEND 4

CHANGES: See other side.

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JEPPESEN MAR 30-90 (11-2A) Eff Apr 5

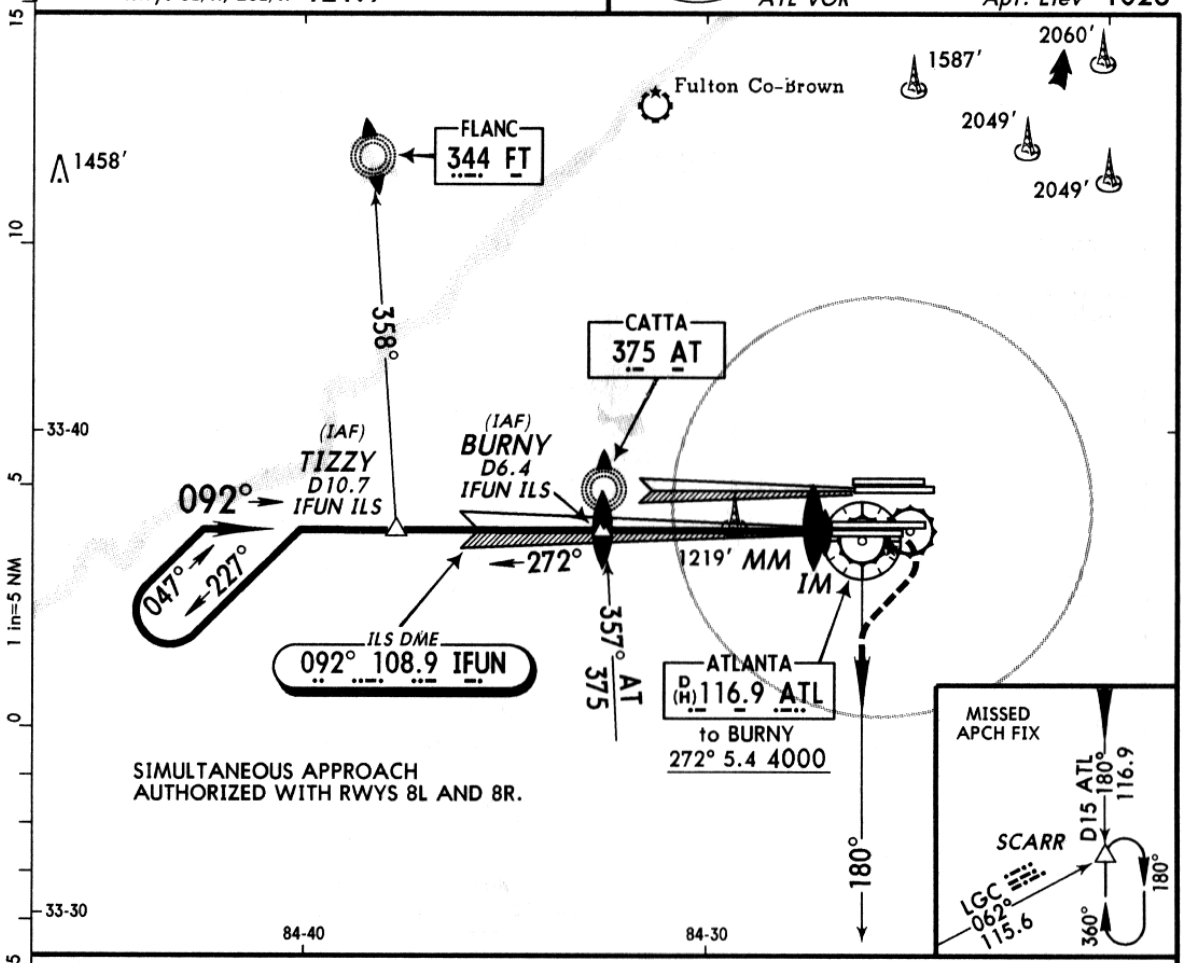
ATLANTA, GA
THE HARTSFIELD ATLANTA INTL
ILS Rwy 9R CAT II & III

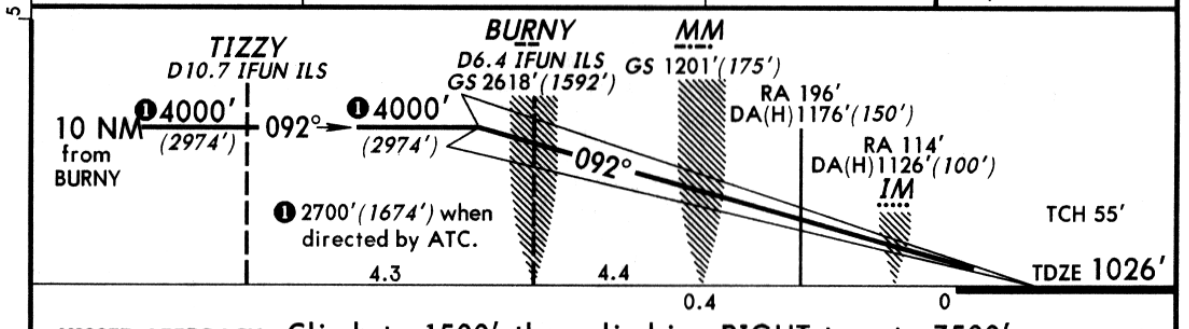
Special Aircrew & Acft Certification Required

LOC 108.9 IFUN

Apt. Elev 1026′

ATIS Arrival 119.65
ATLANTA Approach (R) 127.9
ATLANTA Tower Rwys 9L/R, 27L/R 119.1
Rwys 8L/R, 26L/R 119.5
Ground Rwys 9L/R, 27L/R 121.75
Rwys 8L/R, 26L/R 121.9





MISSED APPROACH: Climb to 1500′ then climbing RIGHT turn to 3500′ outbound via ATL VOR R-180 to SCARR INT/D15.0 ATL and hold.

STRAIGHT-IN LANDING RWY 9R

CAT IIIB ILS	CAT IIIA ILS	CAT II ILS RA 114′ DA(H) 1126′ (100′)	CAT II ILS RA 196′ DA(H) 1176′ (150′)
RVR 3	RVR 7	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	646	754	862

AMEND 16

CHANGES: CAT IIIB added.

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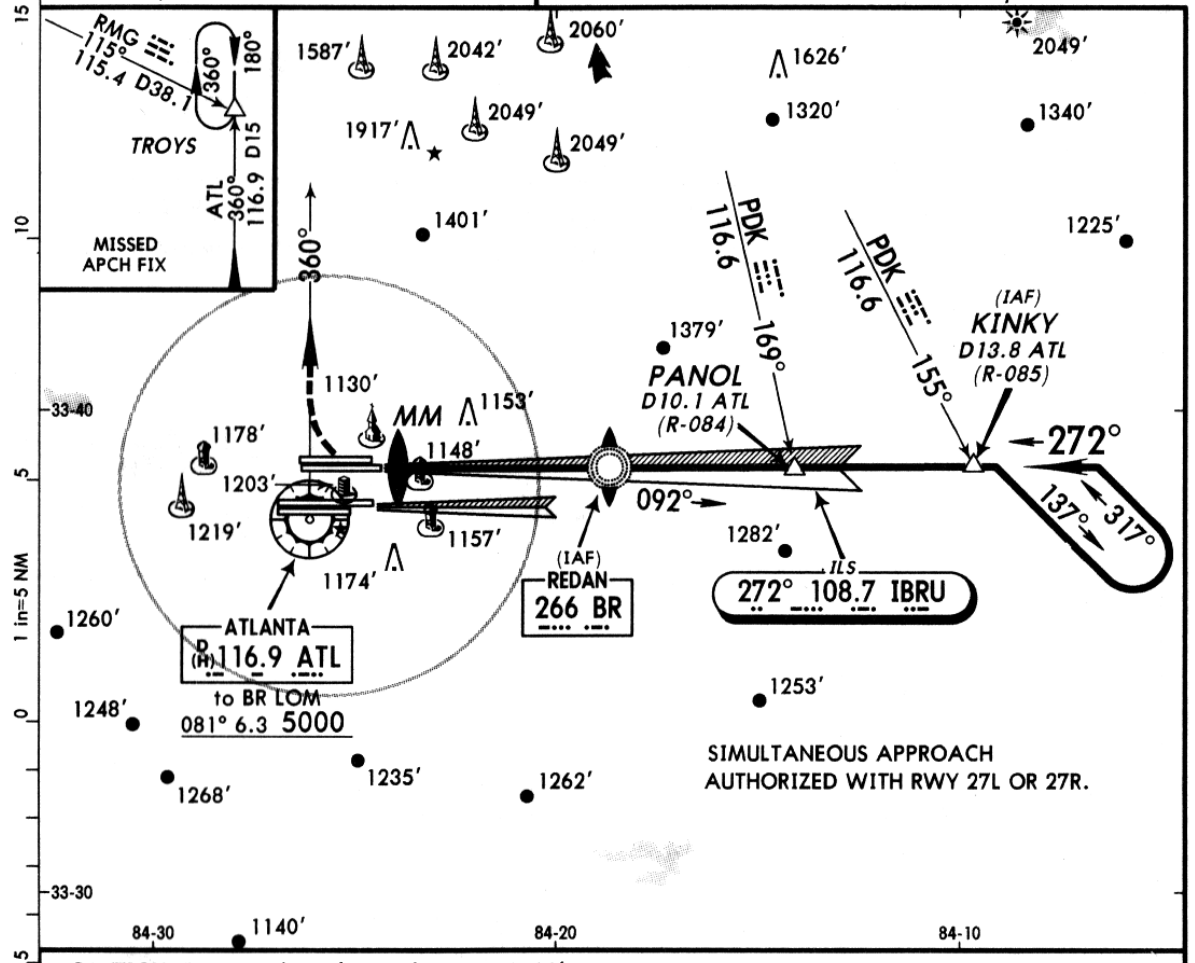
JEPPESEN MAR 4-88 (11-4) Eff Mar 10

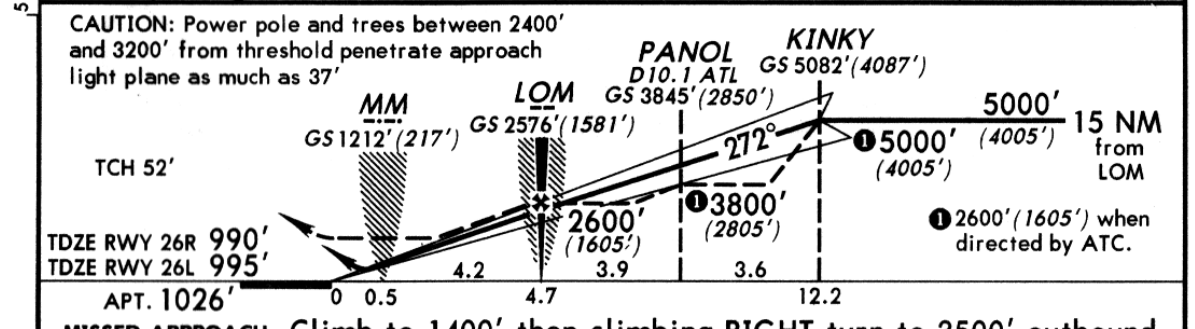
ATLANTA, GA
THE HARTSFIELD ATLANTA INTL
ILS Rwy 26L

LOC 108.7 IBRU

Apt. Elev 1026′

ATIS Arrival 119.65
ATLANTA Approach (R) 127.9
ATLANTA Tower Rwys 9L/R, 27L/R 119.1
Rwys 8L/R, 26L/R 119.5
Ground Rwys 9L/R, 27L/R 121.75
Rwys 8L/R, 26L/R 121.9





MISSED APPROACH: Climb to 1400′ then climbing RIGHT turn to 3500′ outbound via ATL VOR R-360 to TROYS INT/D15.0 ATL and hold.

STRAIGHT-IN LANDING RWY 26L

	ILS DH 1195′ (200′) FULL	ILS DH 1195′ (200′) RAIL or ALS out	ILS DH 1245′ (250′) MM out	LOC (GS out) MDA 1380′ (385′)	LOC (GS out) MM out	LOC (GS out) RAIL out	LOC (GS out) ALS out	SIDESTEP LANDING RWY 26R MDA 1380′ (390′)	SIDESTEP RAIL or ALS out
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2		RVR 40 or 3/4	RVR 50 or 1	RVR 50 or 1	
B									
C								RVR 50 or 1	1 1/2
D			RVR 40 or 3/4	RVR 40 or 3/4	RVR 50 or 1	RVR 60 or 1 1/4		1 1/2	2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	646	754	862
LOM to MAP	4.7	4:02	3:08	2:49	2:21	2:01	1:46

AMEND 17

CHANGES: Printing sequence.

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JEPPESEN JAN 8-88 (11-8)

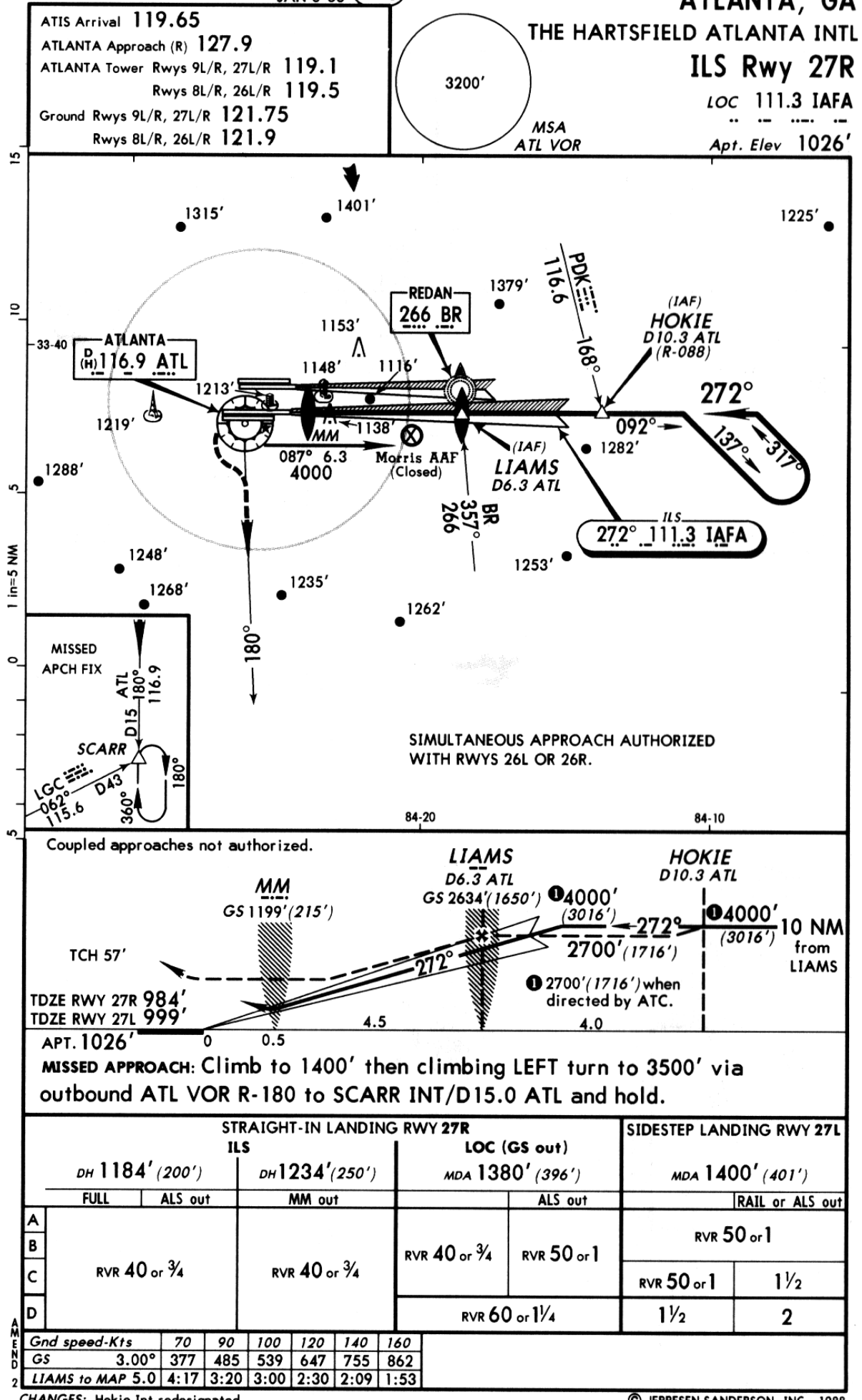
ATLANTA, GA

THE HARTSFIELD ATLANTA INTL

ILS Rwy 27R

ATIS Arrival 119.65
ATLANTA Approach (R) 127.9
ATLANTA Tower Rwys 9L/R, 27L/R 119.1
Rwys 8L/R, 26L/R 119.5
Ground Rwys 9L/R, 27L/R 121.75
Rwys 8L/R, 26L/R 121.9

LOC 111.3 IAFA
Apt. Elev 1026′



MISSED APPROACH: Climb to 1400′ then climbing LEFT turn to 3500′ via outbound ATL VOR R-180 to SCARR INT/D15.0 ATL and hold.

	STRAIGHT-IN LANDING RWY 27R				SIDESTEP LANDING RWY 27L	
	ILS		LOC (GS out)			
	DH 1184′ (200′)	DH 1234′(250′)	MDA 1380′ (396′)		MDA 1400′ (401′)	
	FULL / ALS out	MM out		ALS out	RAIL or ALS out	
A	RVR 40 or ¾	RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1	RVR 50 or 1	
B						
C			RVR 60 or 1¼		RVR 50 or 1	1½
D					1½	2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862
LIAMS to MAP 5.0	4:17	3:20	3:00	2:30	2:09	1:53

AMEND 2

CHANGES: Hokie Int redesignated.

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JEPPESEN MAR 30-90 Eff Apr 5 (10-9)

KATL

AIRPORT

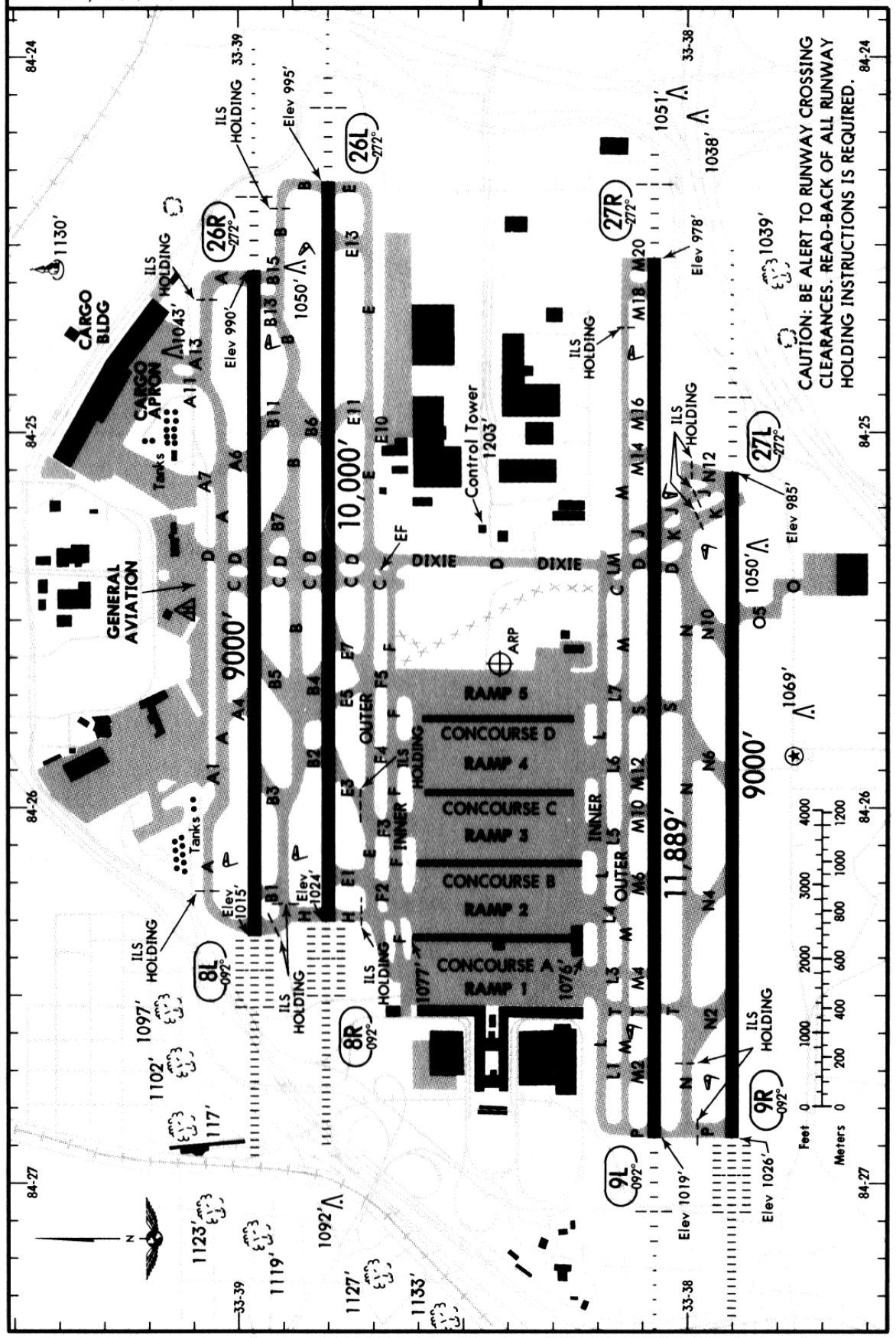
ATLANTA, GA

THE HARTSFIELD ATLANTA INTL

ATL 116.9-On Airport N33 38.4 W084 25.6
Var 02°W Elev 1026′

ATIS Departure 125.55
ATLANTA Clearance (Cpt) 121.65
Ground Rwys 8L/R, 26L/R 121.9
Rwys 9L/R, 27L/R 121.75
Tower Rwys 8L/R, 26L/R 119.5
Rwys 9L/R, 27L/R 119.1

ATLANTA Departure (R)
270°-089° 125.7
090°-269° 125.0
VOT 111.0



CHANGES: See other side.

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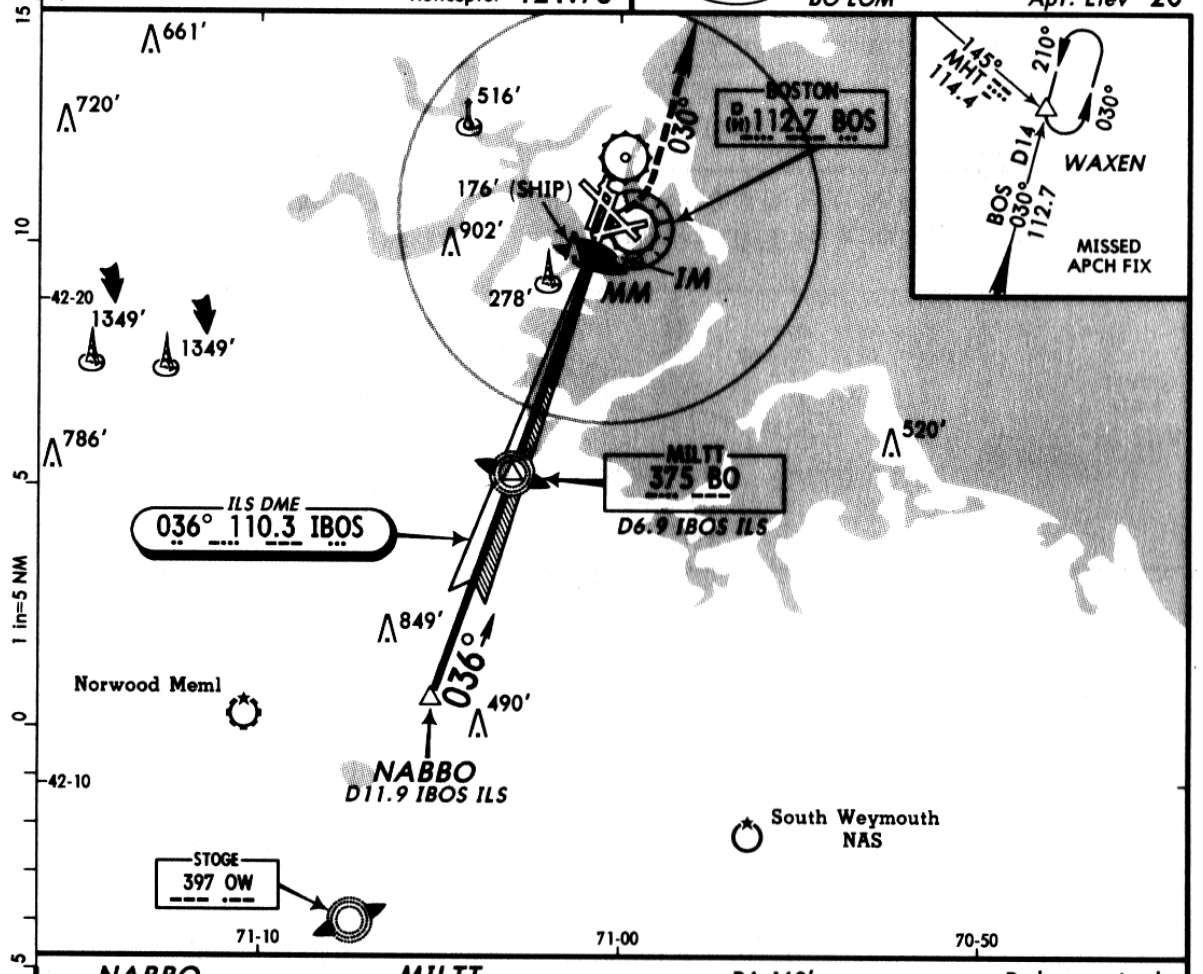
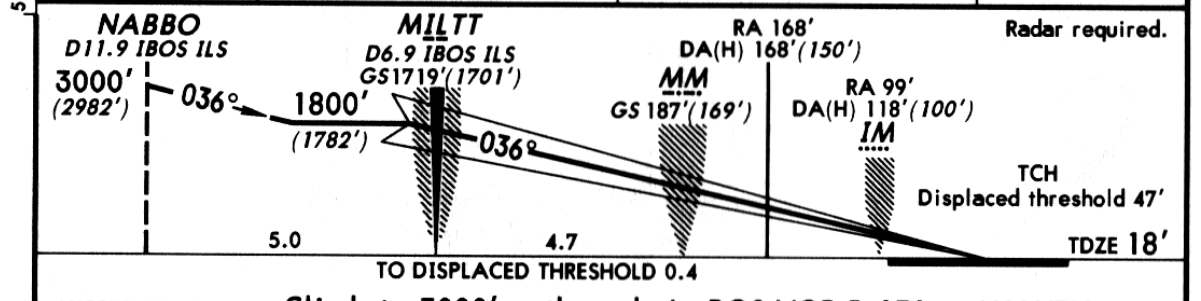
JEPPESEN MAR 30-90 (11-1A)

BOSTON, MASS
LOGAN INTL
ILS Rwy 4R CAT II
Special Aircrew & Acft Certification Required
LOC 110.3 IBOS
Apt. Elev 20'

ATIS 135.0
BOSTON Approach (R) 120.6
BOSTON Tower Rwys 4R-22L, 9-27, 33L/R 119.1
Rwys 4L-22R, 15L/R & Active Runway Crossings 128.8
Ground 121.9 Helicopter 121.75





MISSED APPROACH: Climb to 3000' outbound via BOS VOR R-030 to WAXEN INT/D14.0 BOS VOR and hold.

STRAIGHT-IN LANDING RWY 4R
Approach Not Authorized When Control Tower Reports Tall Vessels in Approach Area. See 11-1.
CAT II ILS

RA 99' DA(H) 118' (100')	RA 168' DA(H) 168' (150')
RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862

AMEND 6

CHANGES: Tower.

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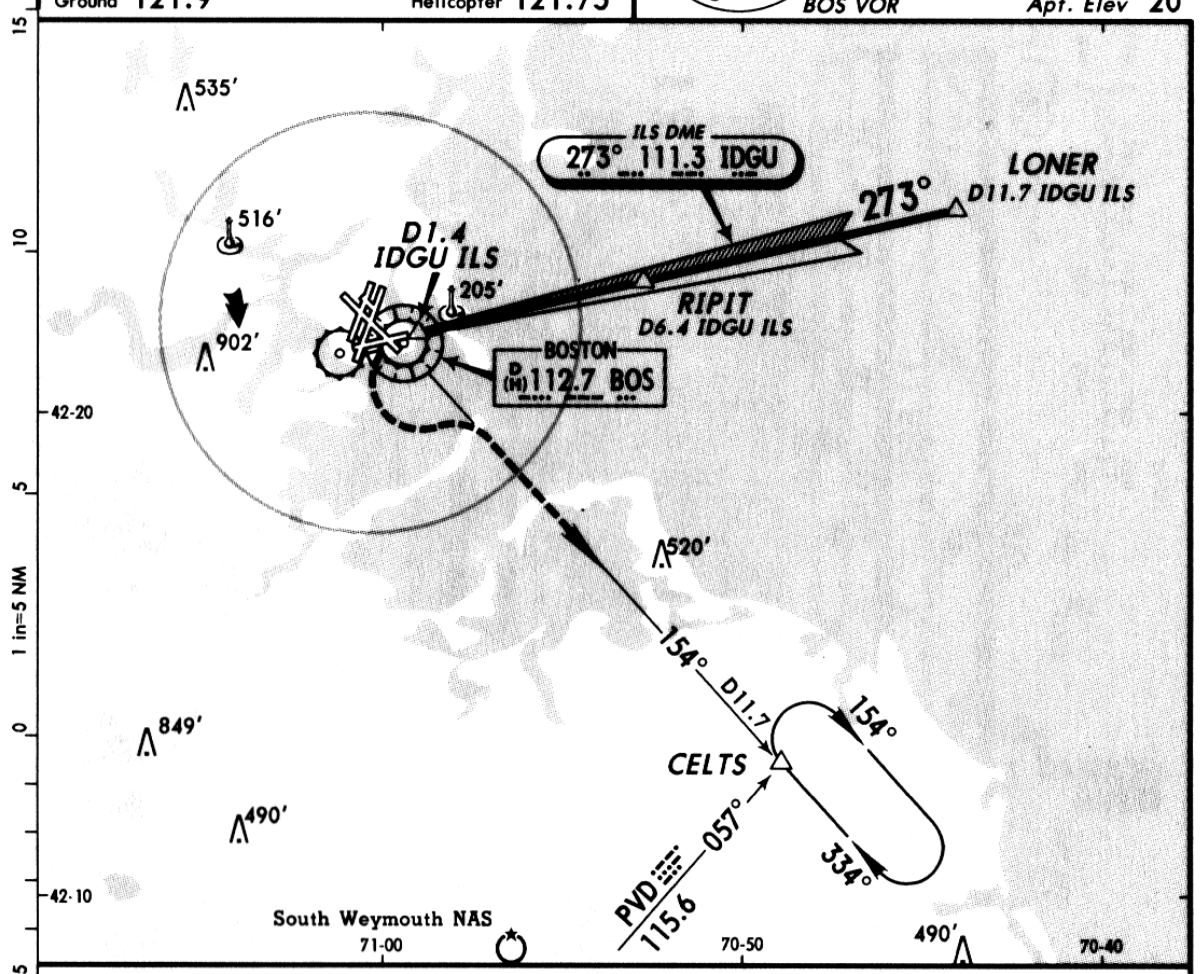
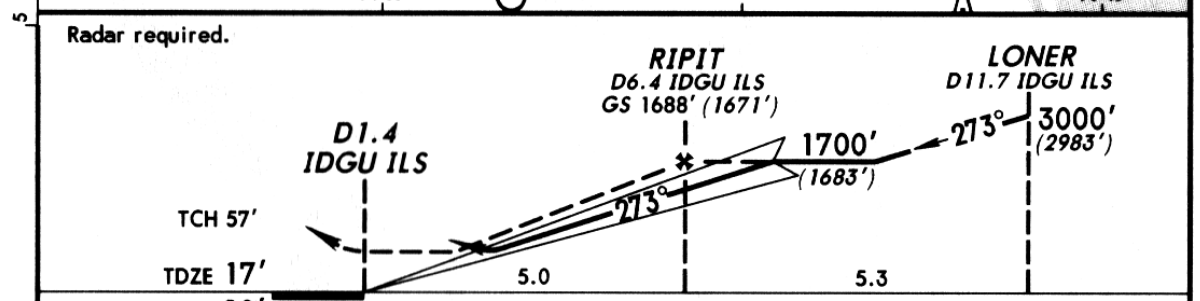
JEPPESEN MAR 30-90 (11-4)

BOSTON, MASS
LOGAN INTL
ILS DME Rwy 27
LOC 111.3 IDGU
Apt. Elev 20'

ATIS 135.0
BOSTON Approach (R) 120.6
BOSTON Tower Rwys 4R-22L, 9-27, 33L/R 119.1
Rwys 4L-22R, 15L/R & Active Runway Crossings 128.8
Ground 121.9 Helicopter 121.75





MISSED APPROACH: Climbing LEFT turn to 3000' outbound via BOS VOR R-154 to CELTS INT and hold.

STRAIGHT-IN LANDING RWY 27

	ILS DA(H) 460' (443')	LOC (GS out) MDA(H) 460' (443')	CIRCLE-TO-LAND Max Kts	MDA(H)
A	1½	RVR 50 or 1	90	620' (600') - 1½
B			120	
C		RVR 60 or 1¼	140	1 620' (600') - 1½
D		1½	165	1 620' (600') - 2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862
MAP at D1.4 IDGU or RIPIT to MAP	5.0	4:17	3:20	3:00	2:30	2:09	1:53

1 NA Rwy 4L clockwise to Rwy 15R.

AMEND 3

CHANGES: Tower.

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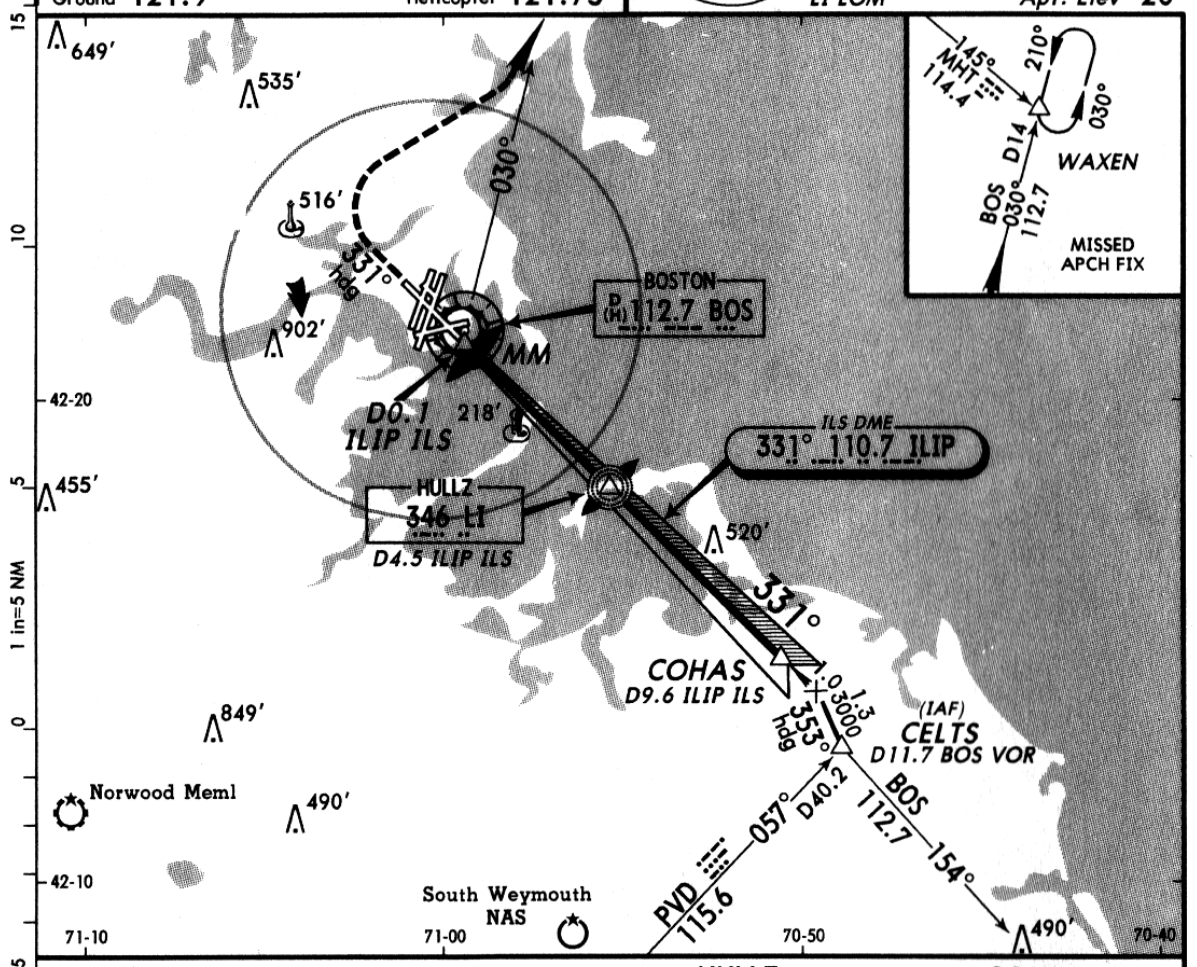
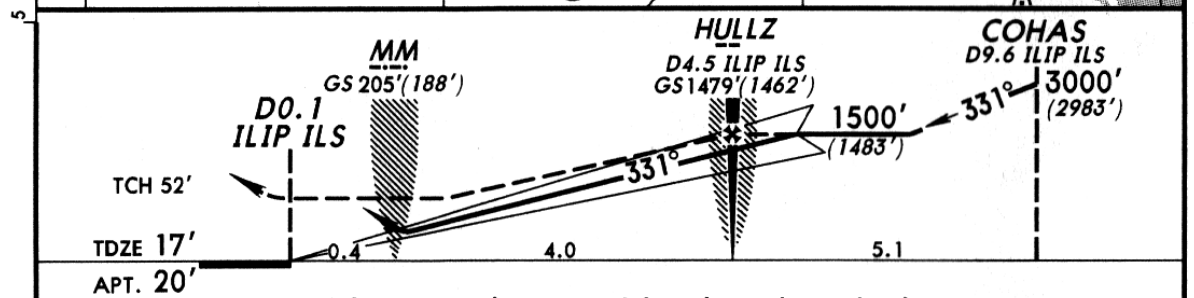
BOSTON, MASS
LOGAN INTL
ILS DME Rwy 33L

ATIS 135.0
BOSTON Approach (R) 120.6
BOSTON Tower Rwys 4R-22L, 9-27, 33L/R 119.1
Rwys 4L-22R, 15L/R & Active Runway Crossings 128.8
Ground 121.9 Helicopter 121.75

LOC 110.7 ILIP
Apt. Elev 20'





MISSED APPROACH: Climb to 1500' via 331° heading then climbing RIGHT turn to 3000' outbound via BOS VOR R-030 to WAXEN INT/D14.0 BOS VOR and hold.

	STRAIGHT-IN LANDING RWY 33L ILS				LOC (GS out)			CIRCLE-TO-LAND	
	DA(H) 217' (200')			DA(H) 267' (250')	MDA(H) 480' (463')				
	FULL	TDZ or CL out	RAIL or ALS out	MM out		RAIL out	ALS out	Max Kts	MDA(H)
A	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	90	620'(600') - 1
B								120	
C					RVR 40 or 3/4	RVR 60 or 1 1/4		140	1 620'(600') - 1 1/2
D	RVR 20 or 1/2			RVR 40 or 3/4	RVR 50 or 1	1 1/2		165	1 620'(600') - 2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	484	538	646	753	861
MAP at D0.1 ILIP or HULLZ to MAP 4.4	3:46	2:56	2:38	2:12	1:53	1:39

1 NA Rwy 4L clockwise to Rwy 15R.

AMEND 21

CHANGES: Tower.

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BOSTON, MASS

LOGAN INTL

BOS 112.7-On Airport N42 21.9 W071 00.3

Var 16°W *Elev* 20′

ATIS 135.0
BOSTON Clearance (Cpt) 121.65
Gate 134.05
Ground 121.9
Tower Rwys 4R-22L, 9-27, 33L 119.1
Rwys 4L-22R, 15R & Active Runway Crossings 128.8 Helicopter 121.75 VOT 111.0

BOSTON Departure (R)
133.0

INTL Terminal arrivals must obtain a gate assignment before entering ramp area on freq 131.1.

SEE INSET FOR INTL TERMINAL GATE POSITIONS

PARKING POSITIONS

STAND	COORDINATES
1A thru 1D	N42 22.1 W071 01.1
2A thru 5	N42 22.2 W071 01.1
6 thru 8B	N42 22.3 W071 01.2

SEE INSET FOR BRAVO HOLD POINT DETAILS

GENERAL AVIATION

Construction Area

Mobile Crane 227′

Mobile Crane 114′

Elev 16′ 22R 216° "ILS Hold Line" "Visual Hold Line" 22L 216°

Elev 15′

DOG LEG

Elev 20′ 15R 151°

Elev 16′ 15L 151°

2557′

Elev 16′ 33R 331°

ARP

10,081′

7860′

10,005′

7000′

27 273° Elev 15′

33L 331° Elev 16′

9 093° 1770′ Stopway

4L 036° 1886′ Stopway "ILS Hold Line" "Visual Hold Line"

Elev 19′ 4R 036°

Elev 15′ Elev 18′

INTL TERMINAL

SOUTHWEST TERMINAL

NORTH TERMINAL

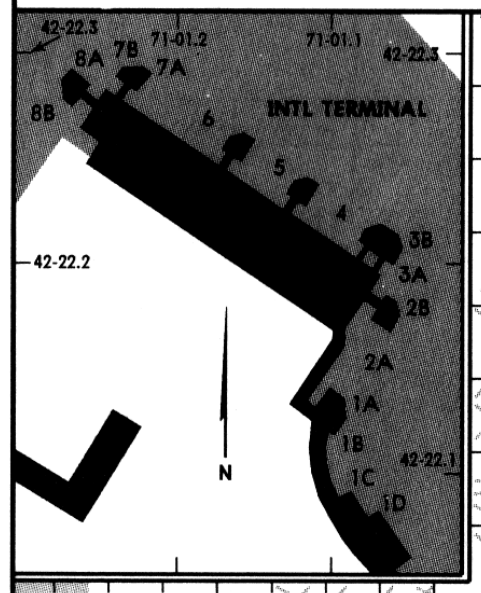
SOUTH TERMINAL

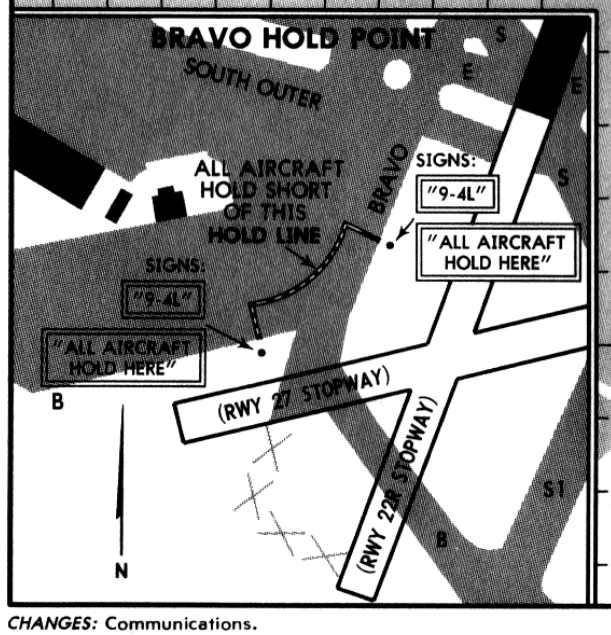
CONTROL TOWER 302′

PIER A PIER B PIER C PIER D

NORTH OUTER NORTH INNER SOUTH INNER SOUTH OUTER

Feet 0 500 1000 1500 2000 2500 3000
Meters 0 200 400 600 800 1000





CHANGES: Communications.

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JEPPESEN NOV 10-89 (21-1A) Eff Nov 16

CHICAGO, ILL
-O'HARE INTL
ILS Rwy 14L CAT II & III

Special Aircrew & Acft Certification Required

LOC 110.9 IOHA

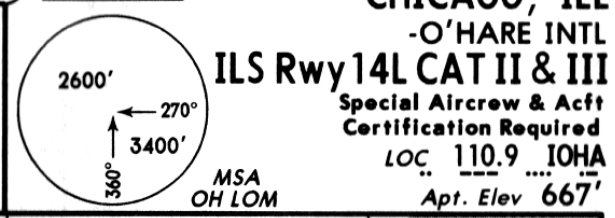
Apt. Elev 667'

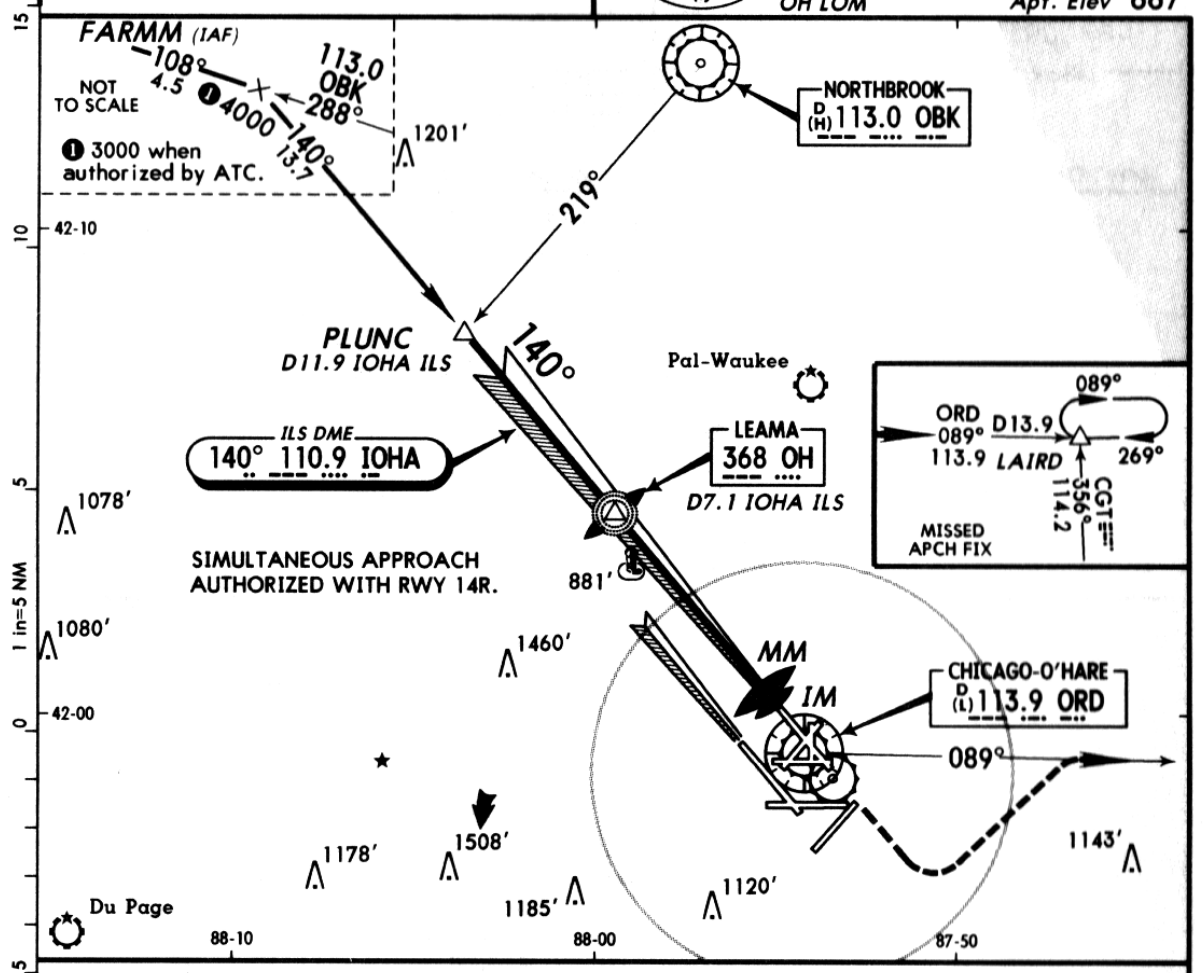
ATIS 135.4

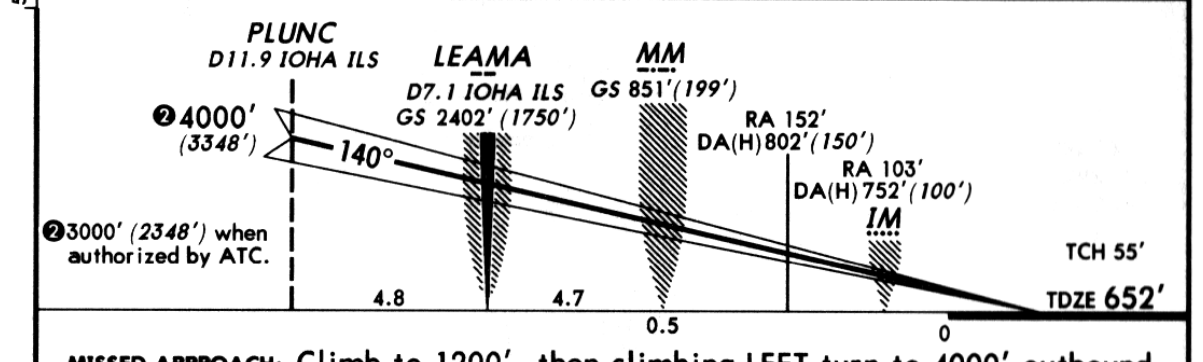
CHICAGO Approach (R) 119.0

O'HARE Tower North 126.9 South 120.75

Ground 121.9







MISSED APPROACH: Climb to 1200', then climbing LEFT turn to 4000' outbound via ORD VOR R-089 to LAIRD INT and hold.

STRAIGHT-IN LANDING RWY 14L

CAT IIIC ILS	CAT IIIB ILS	CAT IIIA ILS	CAT II ILS RA 103' DA(H) 752' (100')	CAT II ILS RA 152' DA(H) 802' (150')
NA	RVR 6	RVR 7	RVR 12	RVR 16

Gnd speed - Kts		70	90	100	120	140	160
GS	3.00°	378	485	539	647	755	863

AMEND 28

CHANGES: Cat III ILS added, printing sequence.

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JEPPESEN NOV 10-89 (21-2A) Eff Nov 16

CHICAGO, ILL
-O'HARE INTL
ILS Rwy 14R CAT II & III

Special Aircrew & Acft Certification Required

LOC 109.7 IORD

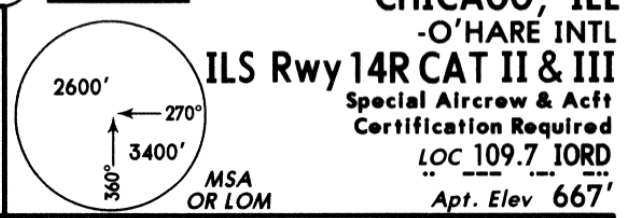
Apt. Elev 667'

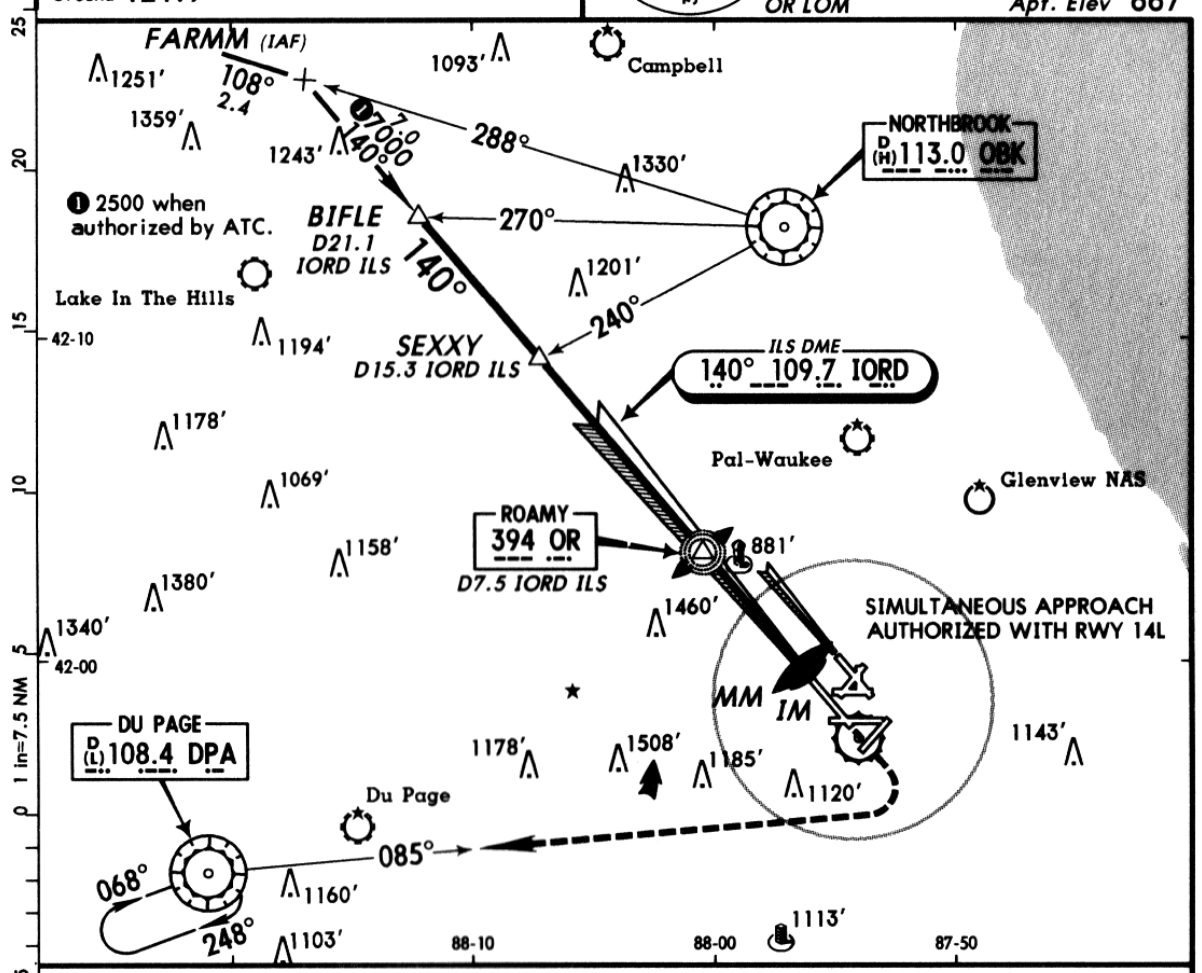
ATIS 135.4

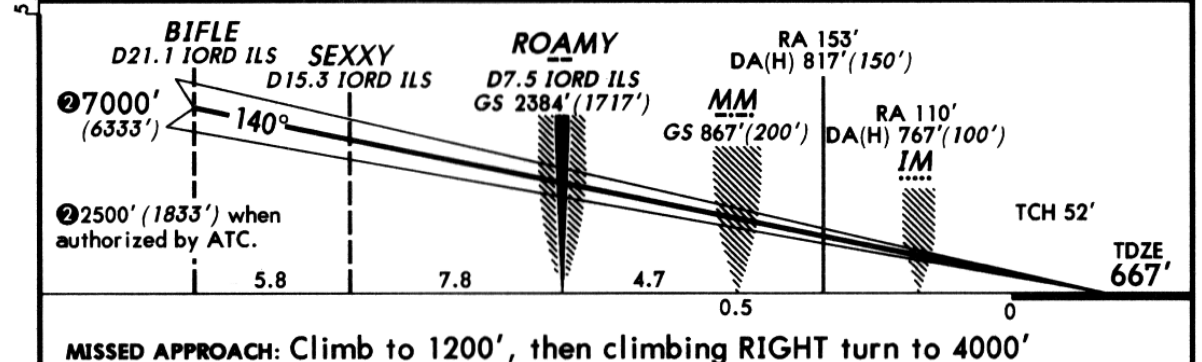
CHICAGO Approach (R) 119.0

O'HARE Tower North 126.9 South 120.75

Ground 121.9







MISSED APPROACH: Climb to 1200', then climbing RIGHT turn to 4000' inbound via DPA VOR R-085 to DPA VOR and hold.

STRAIGHT-IN LANDING RWY 14R

CAT IIIC ILS	CAT IIIB ILS	CAT IIIA ILS	CAT II ILS RA 110' DA(H) 767' (100')	CAT II ILS RA 153' DA(H) 817' (150')
NA	RVR 6	RVR 7	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862

AMEND 29

CHANGES: Cat IIIB ILS minimums, printing sequence.

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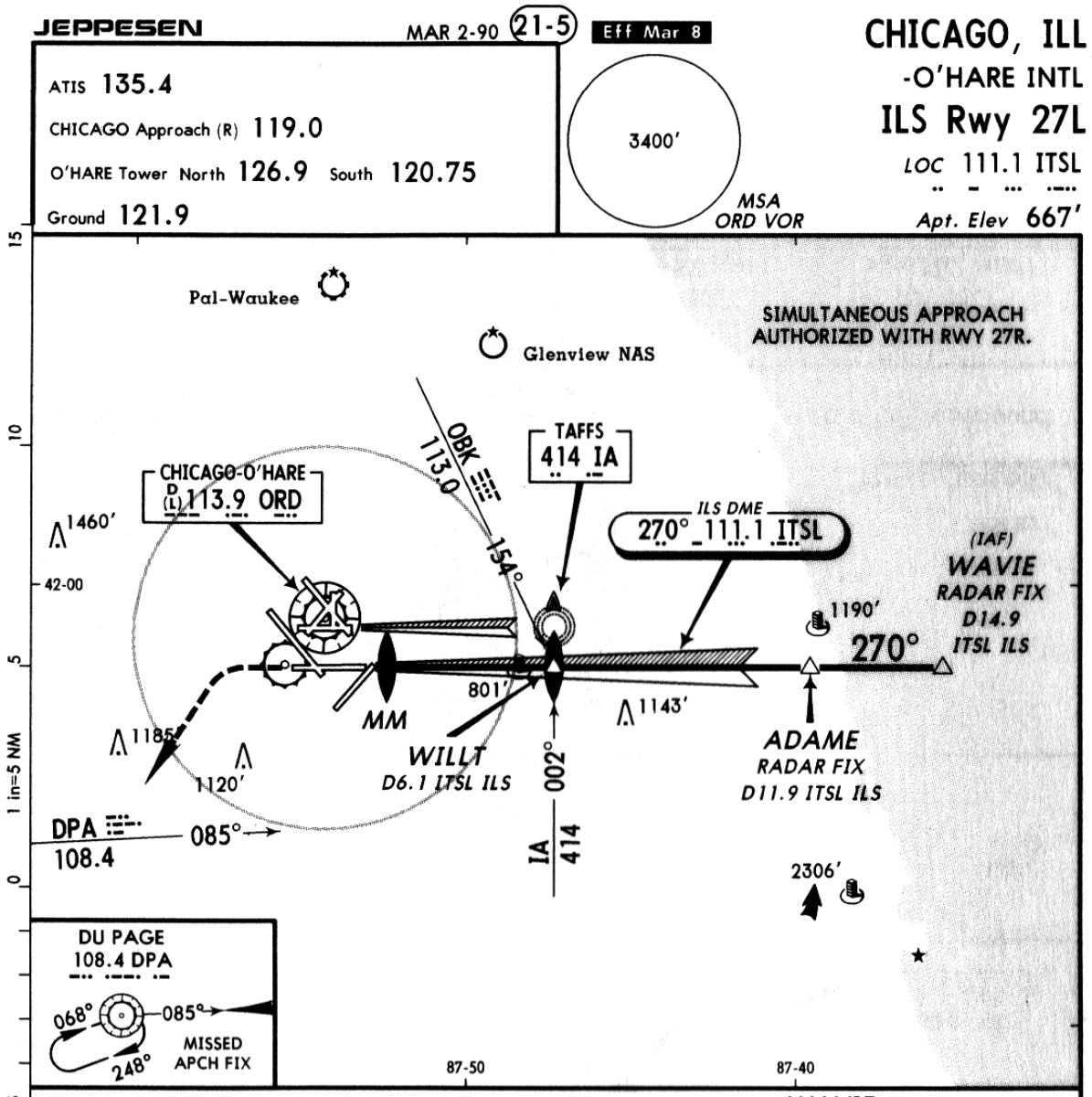
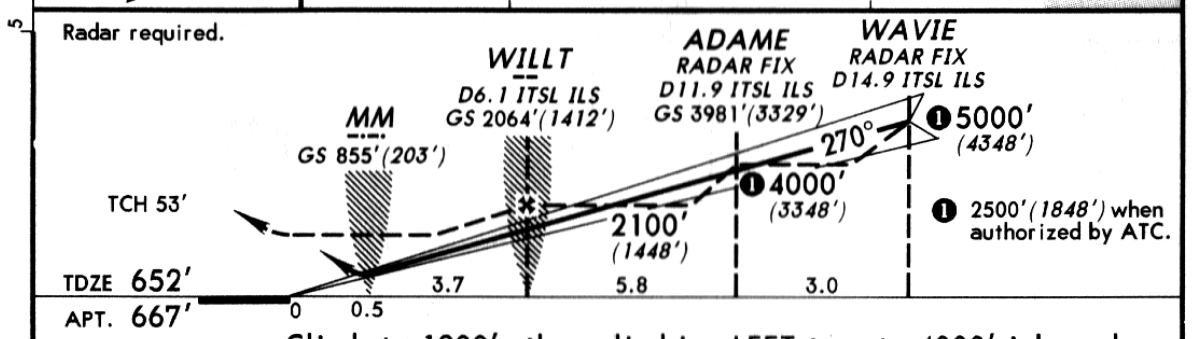
JEPPESEN MAR 2-90 21-5 Eff Mar 8

CHICAGO, ILL
-O'HARE INTL
ILS Rwy 27L

ATIS 135.4
CHICAGO Approach (R) 119.0
O'HARE Tower North 126.9 South 120.75
Ground 121.9

LOC 111.1 ITSL
Apt. Elev 667'





MISSED APPROACH: Climb to 1200', then climbing LEFT turn to 4000' inbound via DPA VOR R-085 to DPA VOR and hold.

STRAIGHT-IN LANDING RWY 27L	ILS				LOC (GS out)			CIRCLE-TO-LAND	
	DA(H) 852'(200')			DA(H) 902'(250')	MDA(H) 1060'(408')			Max Kts	MDA(H)
	FULL	TDZ or CL out	RAIL or ALS out	MM out		RAIL out	ALS out		
A	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	90	1160'(493')-1
B								120	
C				RVR 40 or 3/4	RVR 40 or 3/4	RVR 60 or 1 1/4		140	1160'(493')-1 1/2
D								165	1220'(553')-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	376	484	538	645	753	860
WILLT to MAP 4.2	3:36	2:48	2:31	2:06	1:48	1:34

AMEND 12

CHANGES: Straight-in visibilities, radar fix crossing note.

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JEPPESEN

MAR 30-90 (20-9) **KORD** AIRPORT

CHICAGO, ILL
-O'HARE INTL

ORD 113.9-On Airport N41 58.8 W087 54.3

Var 01°W *Elev* 667′

ATIS 135.4	CHICAGO Departure (R)
O'HARE Clearance(Cpt) 121.6	340°-159° 125.0
Ground Metering 121.67	160°-219° 127.4
Ground Outbound 121.75	220°-339° 125.4
Inbound 121.9	VOT 112.0
Tower North 126.9 South 120.75	

CAUTION: No aircraft are permitted to stop on the Bridge taxiways.

Tower may clear aircraft for take-off runway 14R from taxiway T7-10,100′ is available.

Tower may clear aircraft for take-off runway 32L from taxiway T1-8800′ is available.

Aircraft landing runway 14R may be cleared to hold short of runway 9R-27L, 10,200′ is available.

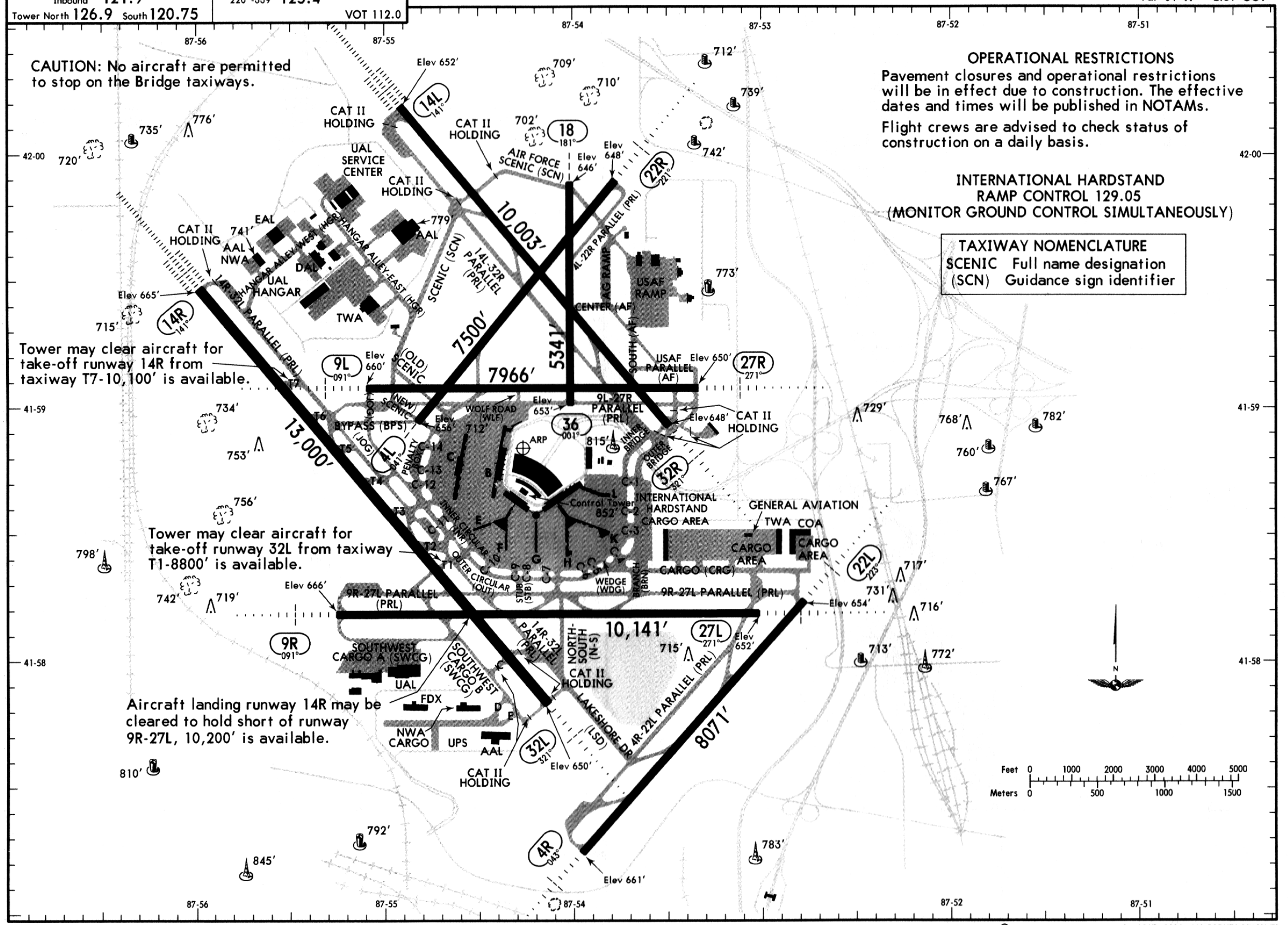
OPERATIONAL RESTRICTIONS

Pavement closures and operational restrictions will be in effect due to construction. The effective dates and times will be published in NOTAMs.

Flight crews are advised to check status of construction on a daily basis.

INTERNATIONAL HARDSTAND
RAMP CONTROL 129.05
(MONITOR GROUND CONTROL SIMULTANEOUSLY)

TAXIWAY NOMENCLATURE
SCENIC Full name designation
(SCN) Guidance sign identifier



CHANGES: Caution note.

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JEPPESEN NOV 11-88 (11-1A) Eff Nov 17

CLEVELAND, OHIO
-HOPKINS INTL
ILS Rwy 5R CAT II

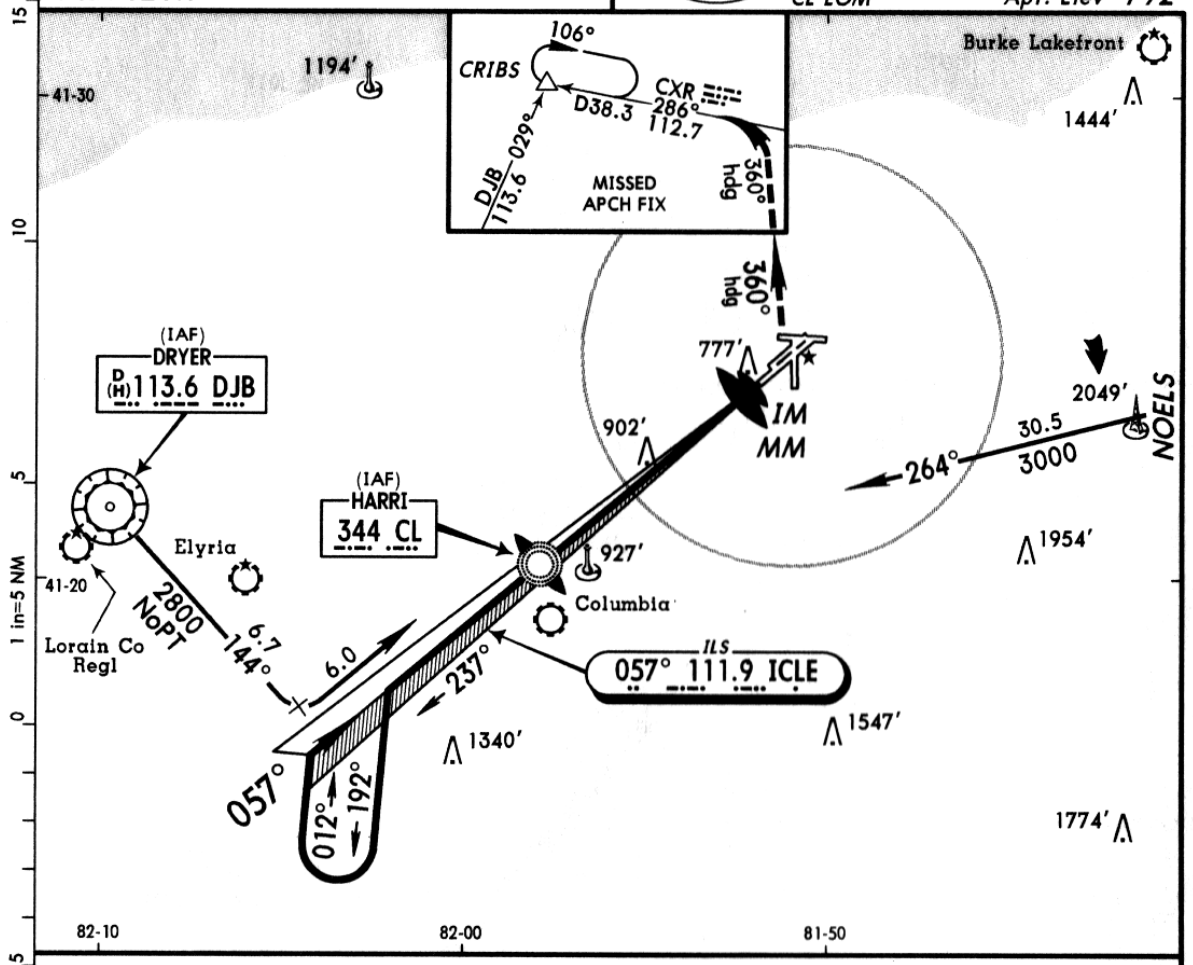
Special Aircrew & Acft Certification Required

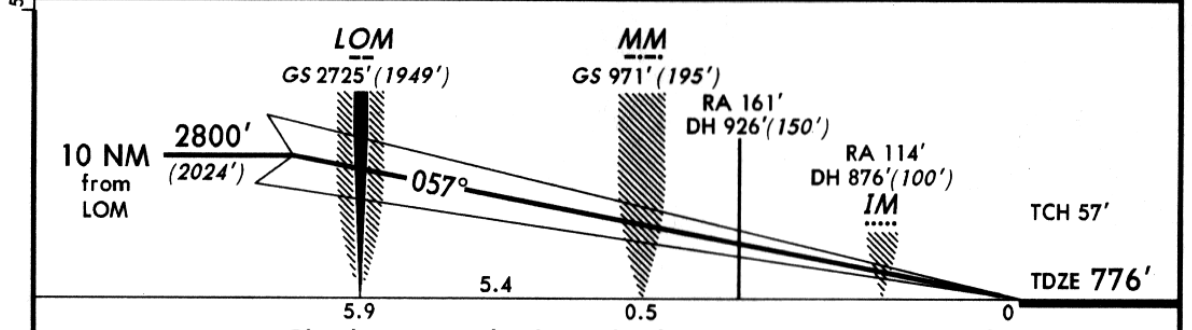
LOC 111.9 ICLE

Apt. Elev 792'

ATIS 127.85
CLEVELAND Approach (R) 124.0
CLEVELAND Tower 120.9
Ground 121.7

MSA CL LOM: 2600' / 3100' (180°–360°)





MISSED APPROACH: Climb to 1400', then climbing LEFT turn to 3000' via heading 360° and outbound CXR VOR R-286 to CRIBS INT and hold.

STRAIGHT-IN LANDING RWY 5R
CAT II ILS

RA 114' DH 876' (100')	RA 161' DH 926' (150')
RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862

AMEND 13

CHANGES: Cribs Int redesignated, GS crossing altitudes, TCH.

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JEPPESEN FEB 24-89 (11-3)

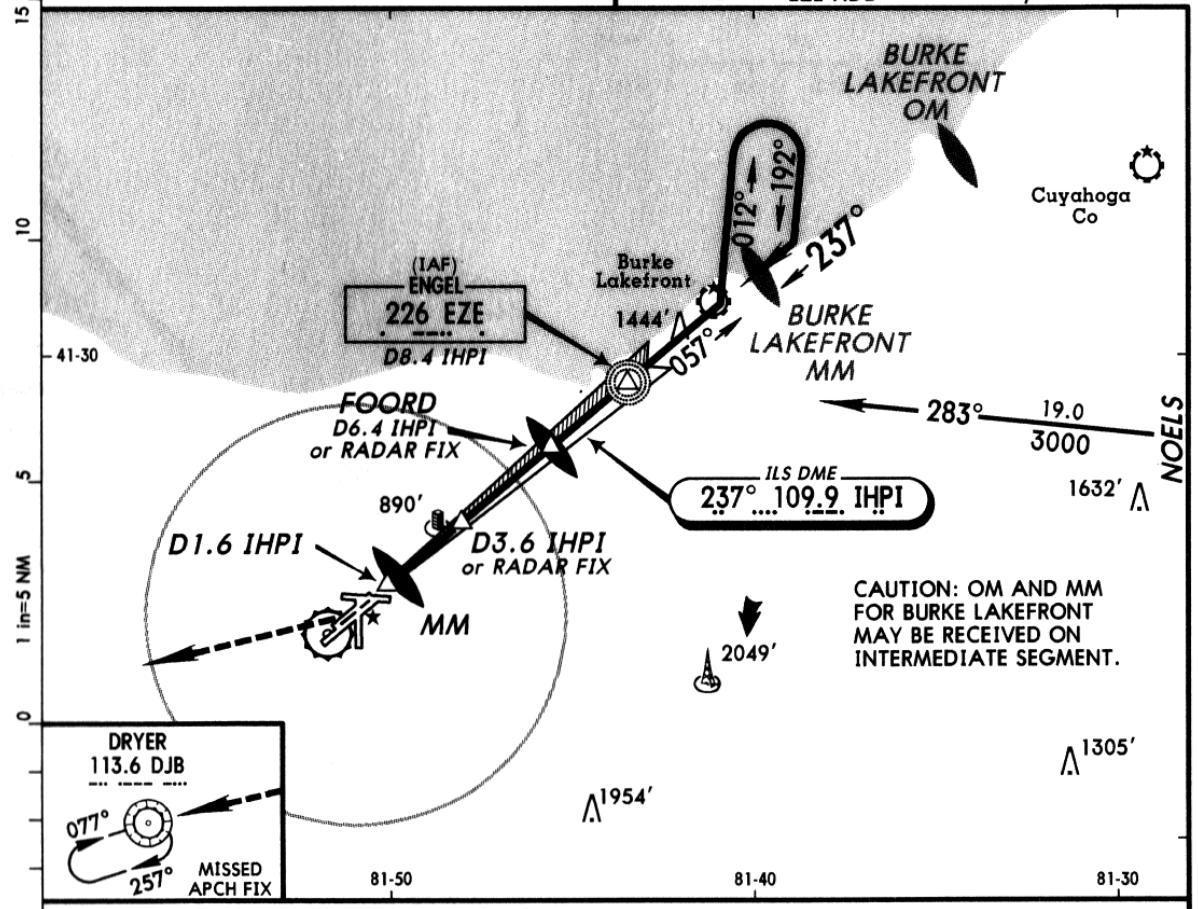
CLEVELAND, OHIO
-HOPKINS INTL
ILS Rwy 23L

LOC 109.9 IHPI

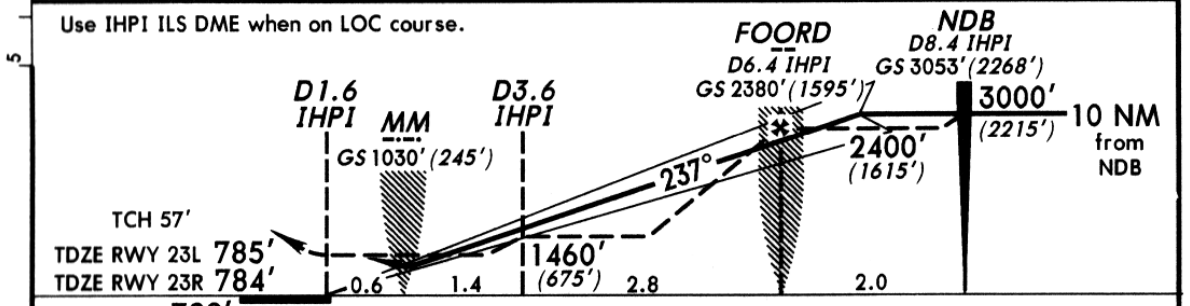
Apt. Elev 792'

ATIS 127.85
CLEVELAND Approach (R) 124.0
CLEVELAND Tower 120.9
Ground 121.7

MSA EZE NDB: 3100'



Use IHPI ILS DME when on LOC course.



MISSED APPROACH: Climb to 1400', then climbing RIGHT turn to 3000' direct DJB VOR and hold.

STRAIGHT-IN LANDING RWY 23L

	ILS DH 1035' (250') FULL	ILS DH 1035' (250') RAIL or ALS out / MM out	LOC (GS out) MDA 1140' (355') With D3.6 IHPI or Radar Fix RAIL or ALS out	LOC (GS out) MDA 1460' (675') W/o D3.6 IHPI & Radar Fix RAIL or ALS out	SIDESTEP LANDING RWY 23R MDA 1140' (356') With D3.6 IHPI or Radar Fix	SIDESTEP LANDING RWY 23R MDA 1460' (676') W/o D3.6 IHPI & Radar Fix	CIRCLE-TO-LAND MDA
A	RVR 40 or ¾	RVR 50 or 1	RVR 50 or 1	RVR 50 or 1	1	1	1460' (668') - 1
B							
C				1½	1½	2	1460' (668') - 2
D			RVR 50 or 1	RVR 60 or 1¼ 1¾	2	2¼	1460' (668') - 2¼

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	646	754	862
MAP at D1.6 IHPI or FOORD to MAP	4.8	4:07	3:12	2:53	2:24	2:03	1:48

Air carrier landing visibility reduction for local conditions not authorized.

AMEND 13

CHANGES: See other side.

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JEPPESEN FEB 17-89 (10-9)

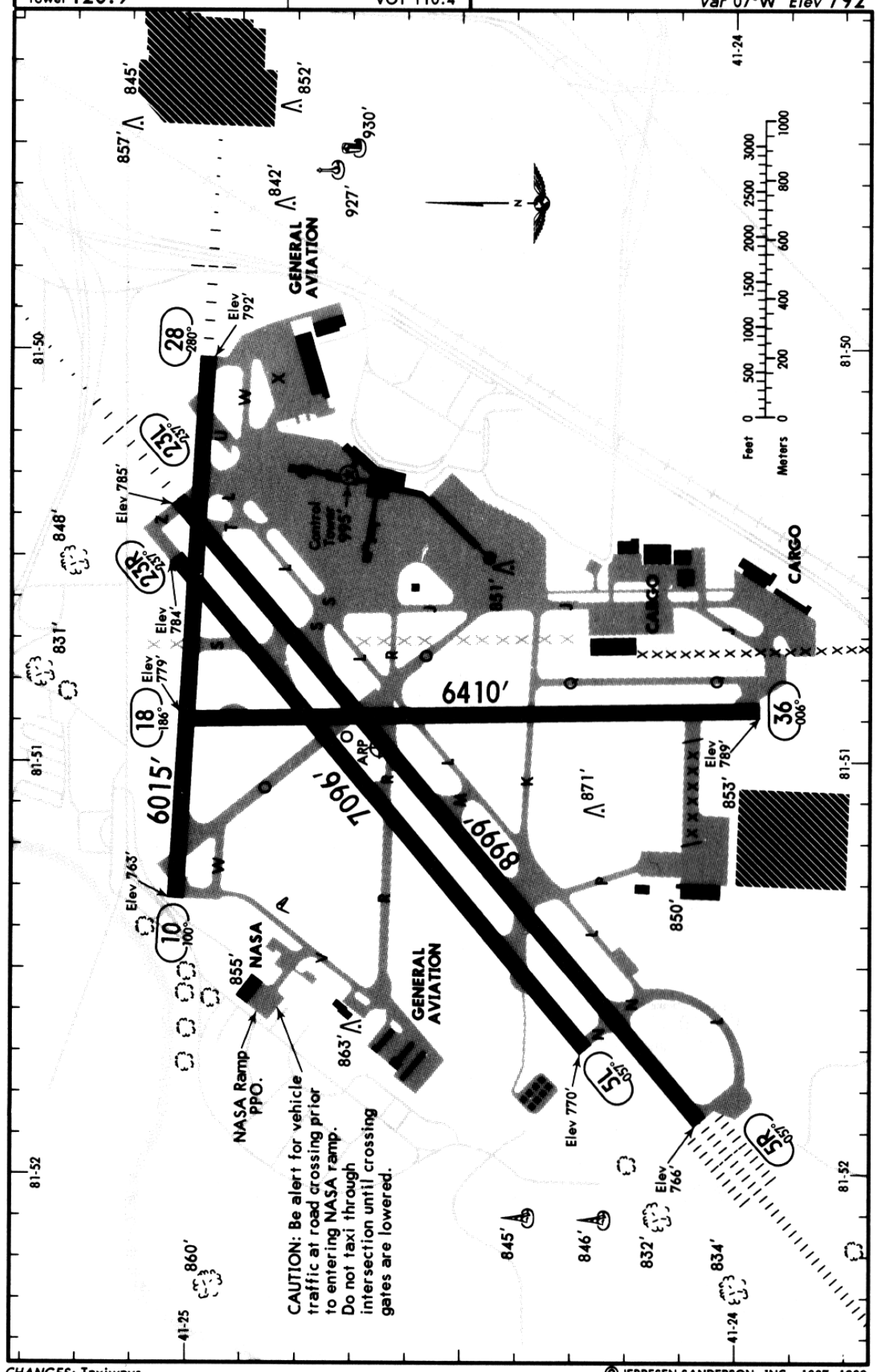
AIRPORT

KCLE CLEVELAND, OHIO -HOPKINS INTL

ATIS 127.85
CLEVELAND Clearance (Cpt) 125.05
Ground 121.7
Tower 120.9

CLEVELAND Departure (R)
234°-053° 118.9
054°-233° 118.15
VOT 110.4

082.2°/14.5 From DJB 113.6 N41 24.7 W081 51.0
Var 07°W Elev 792'



CHANGES: Taxiways.

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JEPPESEN MAR 31-89 Eff Apr 6 (61-7)

DALLAS-FT WORTH, TEXAS

DALLAS-FT WORTH INTL

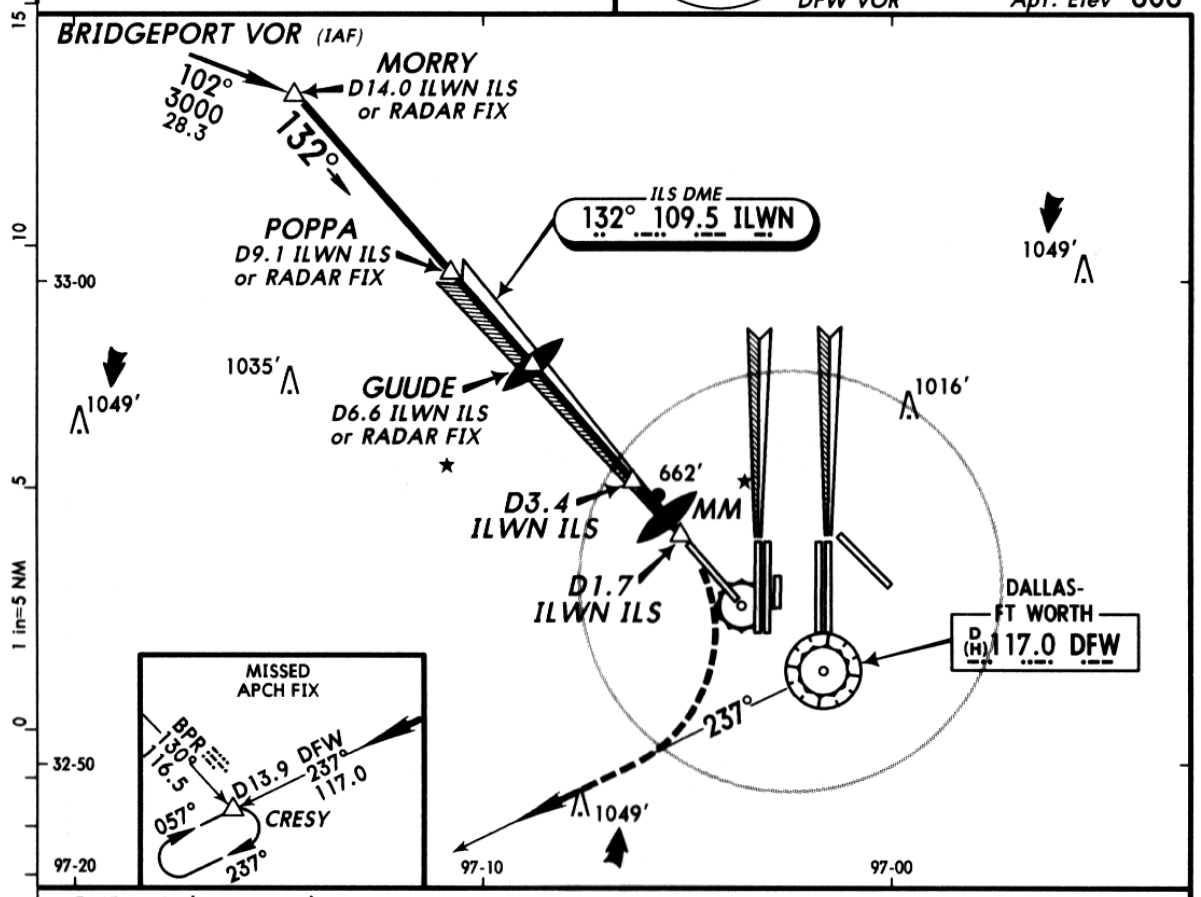
ILS-1 Rwy 13R

LOC 109.5 ILWN

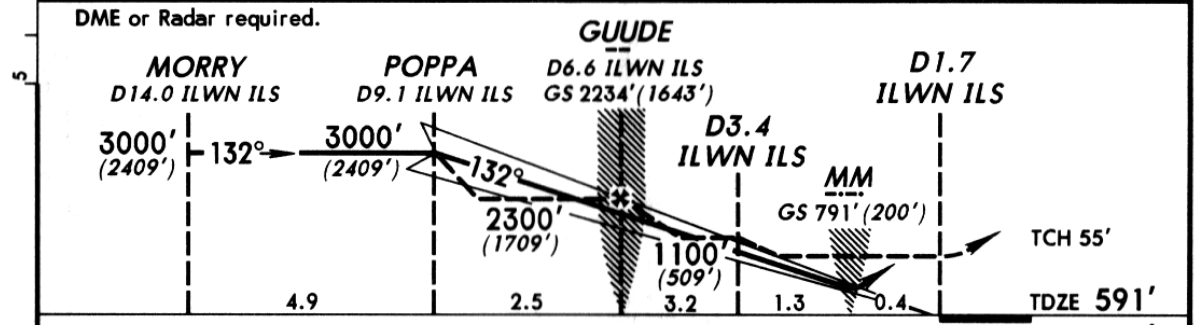
Apt. Elev 603'

ATIS Arrival 117.0 134.9
REGIONAL Approach (R) East 119.05 West 125.8
REGIONAL Tower East 126.55 West 124.15
Ground East 121.65 West 121.8

MSA DFW VOR
2600'
090° 270°
3400'



DME or Radar required.



MISSED APPROACH: Climbing RIGHT turn to 3000' outbound via DFW VOR R-237 to CRESY INT and hold.

STRAIGHT-IN LANDING RWY 13R

	ILS				LOC (GS out)					
	DH 791' (200')			DH 841' (250')	MDA 920' (329') With D3.4				MDA 1100' (509') Without D3.4		
	FULL	TDZ or CL out	RAIL or ALS out	MM out		MM out	RAIL out	ALS out		RAIL out	ALS out
A	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½		RVR 40 or ¾	RVR 50 or 1	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1
B											
C									RVR 50 or 1	1½	
D				RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1					

	Gnd speed-Kts	70	90	100	120	140	160
	GS 3.00°	377	485	539	647	754	862
	MAP at D1.7 or GUUDE to MAP 4.9	4:12	3:16	2:56	2:27	2:06	1:50

AMEND 1

CHANGES: Procedure.

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JEPPESEN MAY 26-89 (61-1A)

DALLAS-FT WORTH, TEXAS

DALLAS/FT WORTH INTL

ILS-1 Rwy17L CAT II

Special Aircrew & Acft Certification Required

LOC 109.1 IFLQ

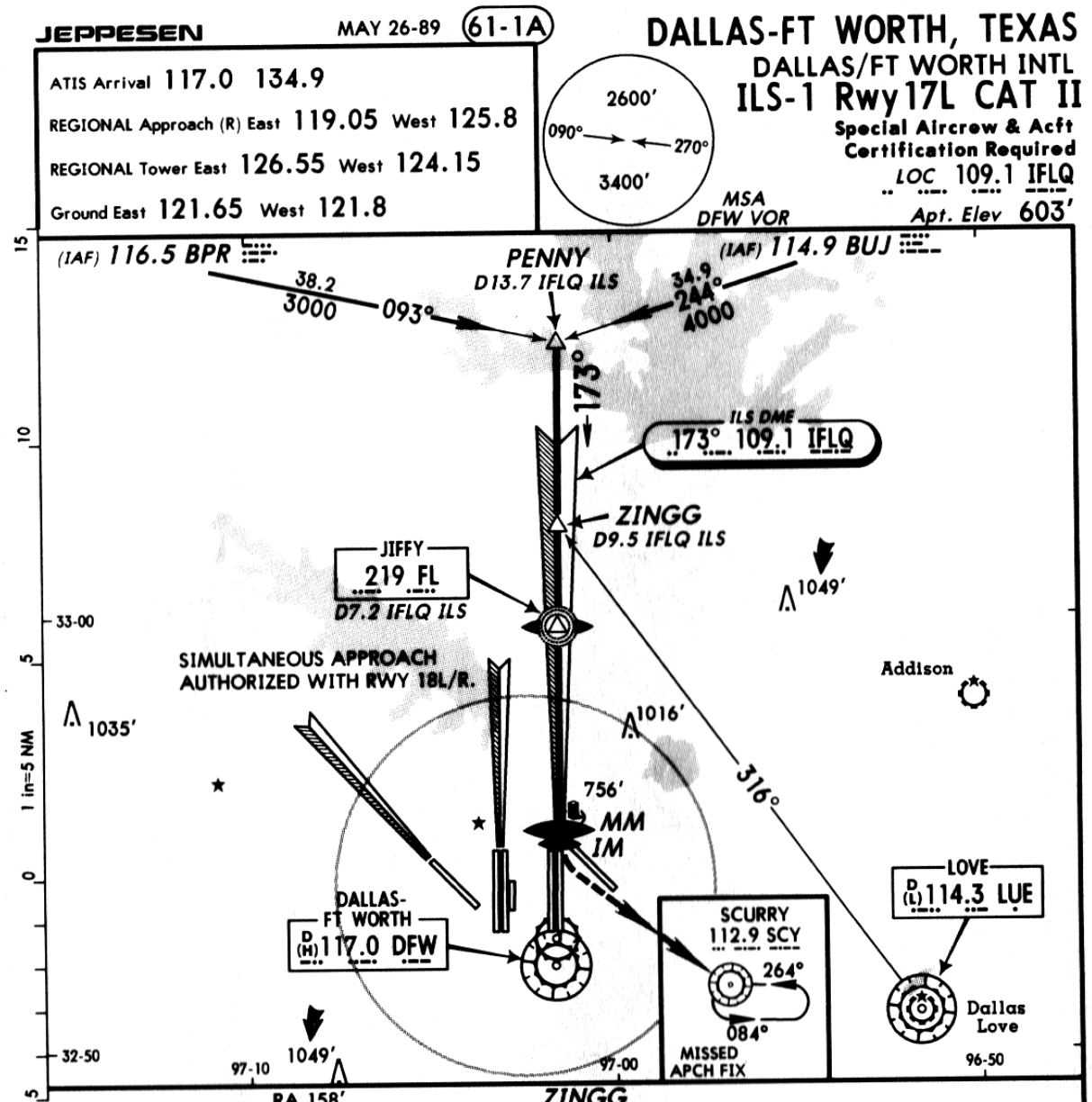
Apt. Elev 603'

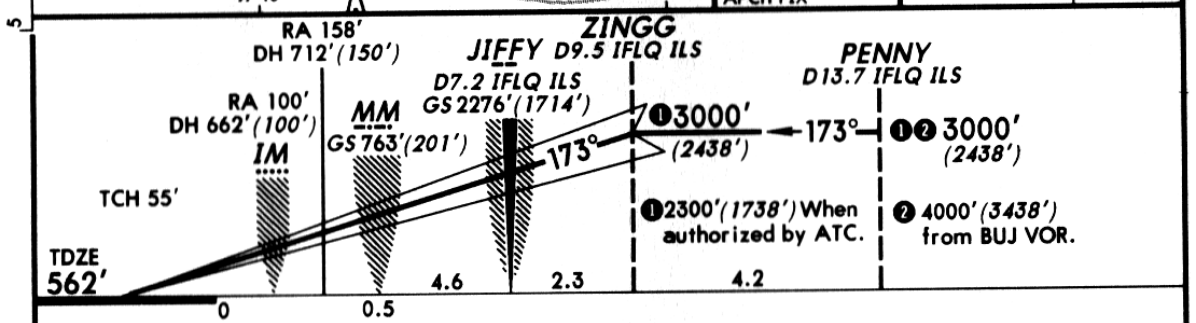
ATIS Arrival 117.0 134.9

REGIONAL Approach (R) East 119.05 West 125.8

REGIONAL Tower East 126.55 West 124.15

Ground East 121.65 West 121.8





MISSED APPROACH: Climbing LEFT turn to 3300' direct SCY VOR and hold.

STRAIGHT-IN LANDING RWY 17L

CAT II ILS

RA 100' DH 662' (100')	RA 158' DH 712' (150')
RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	863

AMEND 3

CHANGES: MSA.

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JEPPESEN JUL 28-89 (61-11)

DALLAS-FT WORTH, TEXAS

DALLAS/FT WORTH INTL

CONVERGING ILS-2 Rwy 17R

LOC 111.5 IJHZ

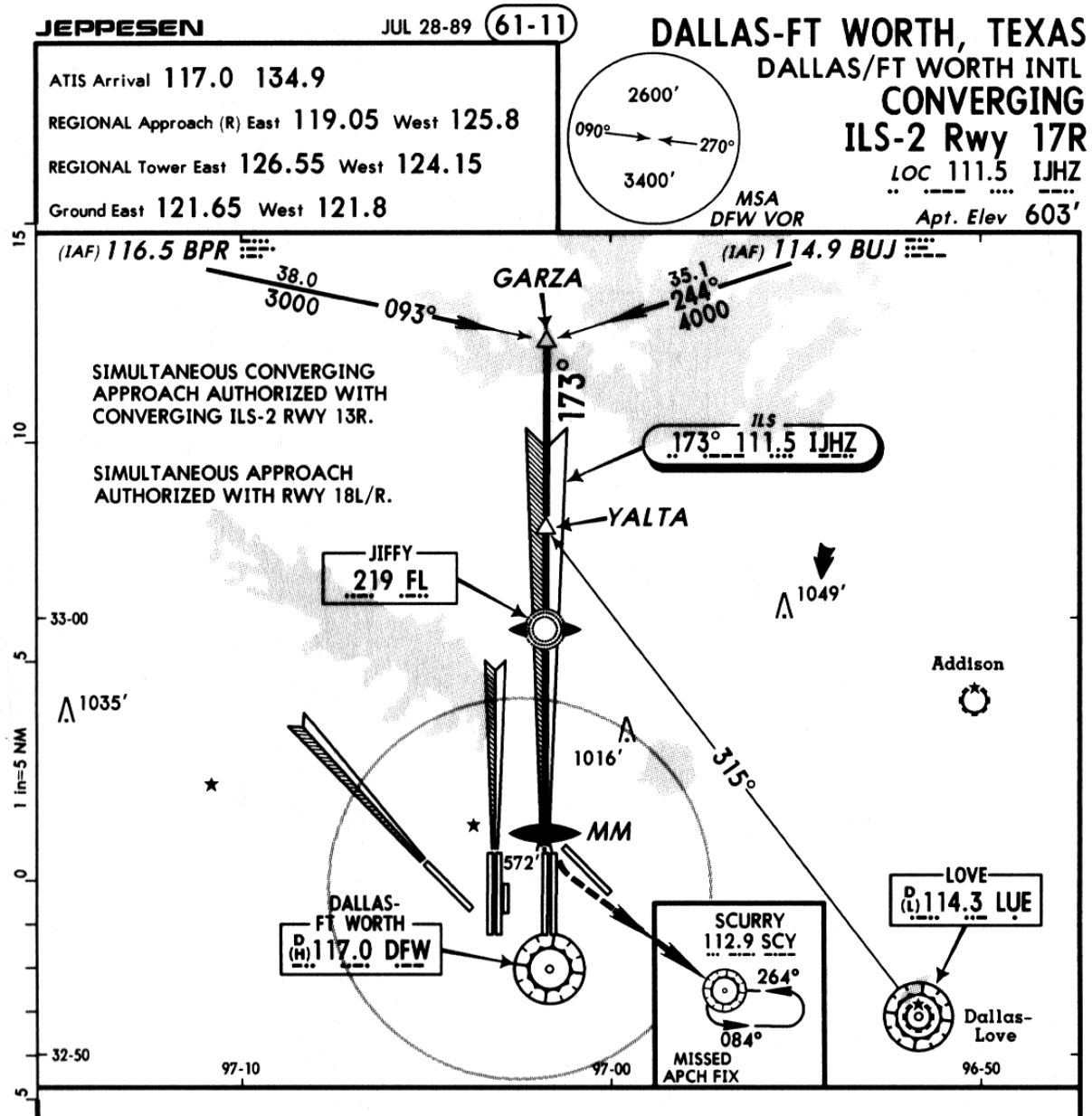
Apt. Elev 603'

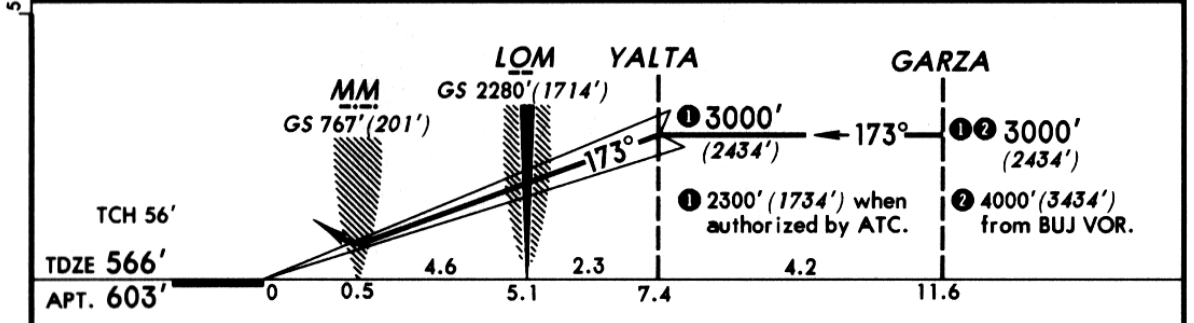
ATIS Arrival 117.0 134.9

REGIONAL Approach (R) East 119.05 West 125.8

REGIONAL Tower East 126.55 West 124.15

Ground East 121.65 West 121.8





MISSED APPROACH: Climbing LEFT turn to 3300' direct SCY VOR and hold.

STRAIGHT-IN LANDING RWY 17R

	ILS				LOC (GS out)
	DA(H) 766' (200')			DA(H) 816' (250')	
	FULL	TDZ or CL out	RAIL or ALS out	MM out	
A, B, C	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	NA
D	RVR 20 or 1/2			RVR 40 or 3/4	

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 2

CHANGES: LOC (GS out) minimumus NA.

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JEPPESEN JUL 28-89 (61-12)

DALLAS-FT WORTH, TEXAS

DALLAS/FT WORTH INTL

CONVERGING ILS-2 Rwy 18L

LOC 111.3 ICIX

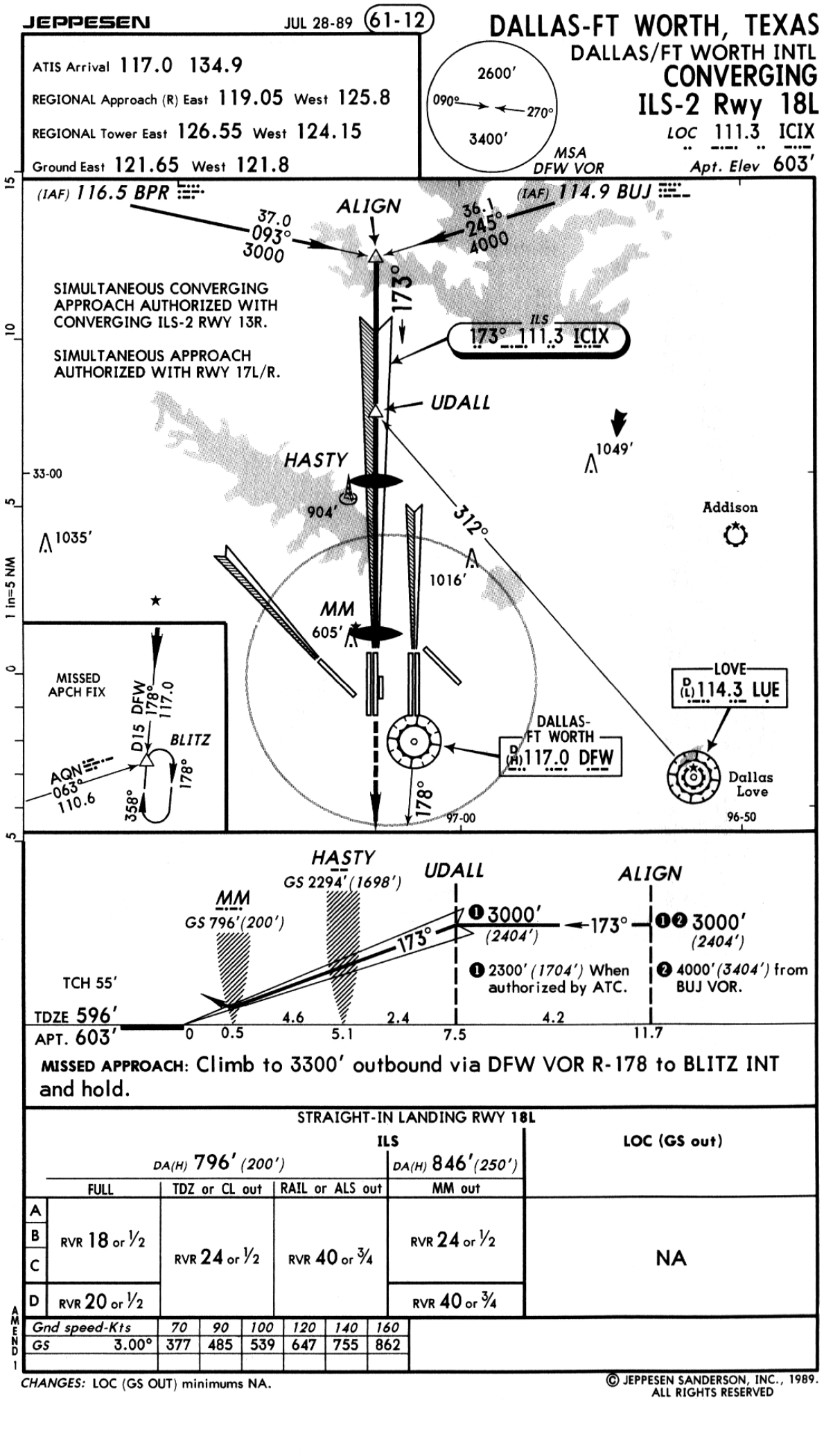
Apt. Elev 603′

ATIS Arrival 117.0 134.9

REGIONAL Approach (R) East 119.05 West 125.8

REGIONAL Tower East 126.55 West 124.15

Ground East 121.65 West 121.8



MISSED APPROACH: Climb to 3300′ outbound via DFW VOR R-178 to BLITZ INT and hold.

STRAIGHT-IN LANDING RWY 18L

	ILS DA(H) 796′ (200′) FULL	ILS DA(H) 796′ (200′) TDZ or CL out	ILS DA(H) 796′ (200′) RAIL or ALS out	ILS DA(H) 846′ (250′) MM out	LOC (GS out)
A	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	NA
B					
C					
D	RVR 20 or ½			RVR 40 or ¾	

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 1

CHANGES: LOC (GS OUT) minimums NA.

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JEPPESEN MAR 31-89 Eff Apr 6 (61-2A)

DALLAS-FT WORTH, TEXAS

DALLAS/FT WORTH INTL

ILS-1 Rwy18R CAT II

Special Aircrew & Acft Certification Required

LOC 111.9 IVYN

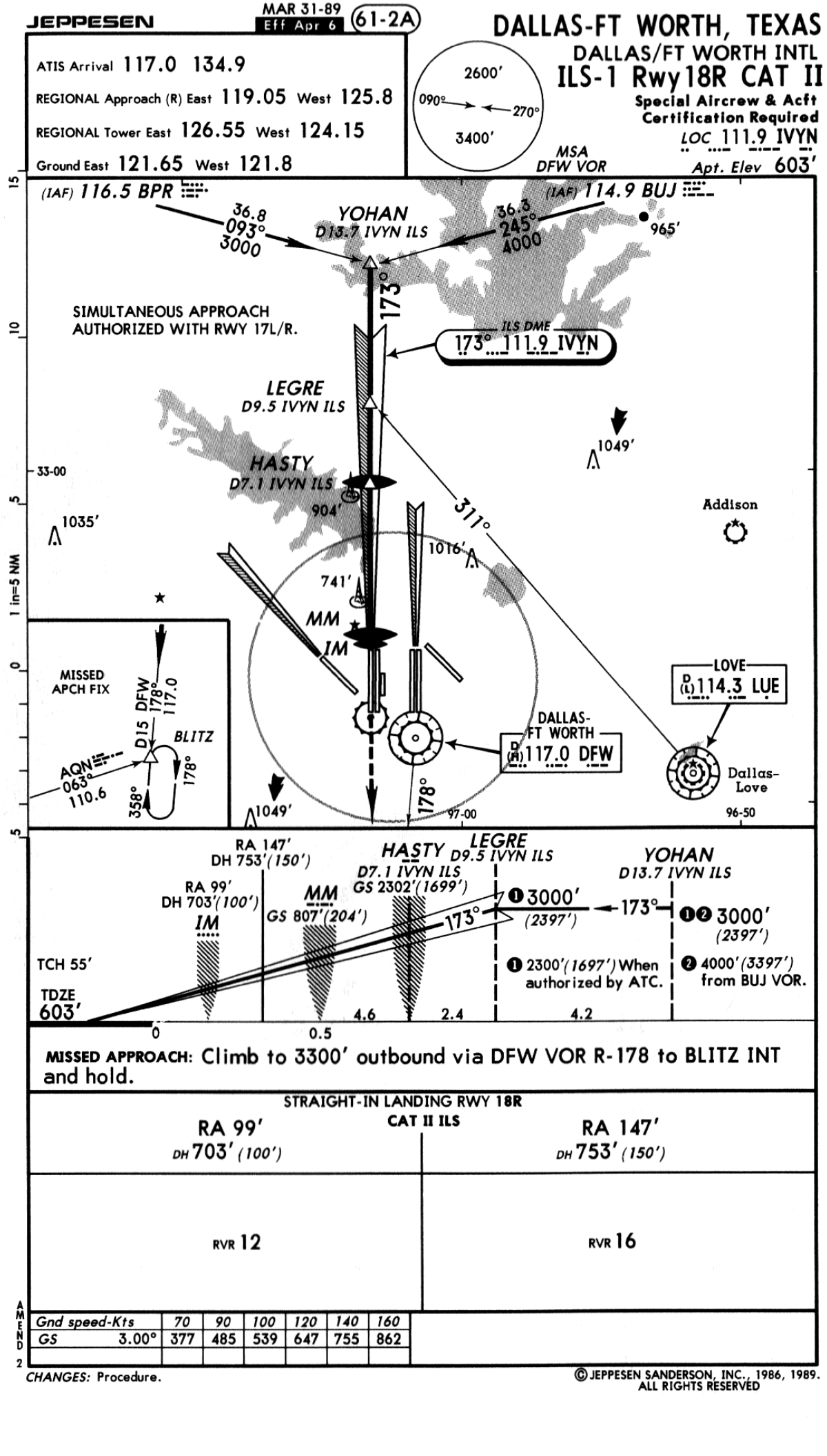
Apt. Elev 603′

ATIS Arrival 117.0 134.9

REGIONAL Approach (R) East 119.05 West 125.8

REGIONAL Tower East 126.55 West 124.15

Ground East 121.65 West 121.8



MISSED APPROACH: Climb to 3300′ outbound via DFW VOR R-178 to BLITZ INT and hold.

STRAIGHT-IN LANDING RWY 18R

CAT II ILS RA 99′ DH 703′ (100′)	CAT II ILS RA 147′ DH 753′ (150′)
RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 2

CHANGES: Procedure.

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DALLAS-FT WORTH, TEXAS

DALLAS/FT WORTH INTL

331.7°/2.0 From DFW 117.0 N32 53.8 W097 02.5

Var 06°E *Elev* 603′

JEPPESEN

ATIS Departure	135.5			REGIONAL Departure (R)	
REGIONAL Clearance	128.25			North & South	127.75
Ground	East 121.65	West 121.8		East	118.55
Tower	East 126.55	West 124.15		West	124.25

97-05 97-04 97-03 97-02 97-01 97-00

32-55 32-54 32-53 32-52

750′ 730′ 746′ 778′

Elev 591′ 52

13R 135°

9300′

31L 315°

Elev 577′ 57

11,388′

18R 174° Elev 603′

18L 174° CAT II HOLD Elev 596′ OUTER INNER

17R 174° INNER OUTER Elev 563′ Elev 566′

17L 174° CAT II HOLD 60

Elev 553′

13L 129°

WEST AIR FREIGHT

660′

CAT II HOLDING

EAST AIR FREIGHT

CAT II HOLDING

M N O

9000′

31R 309°

Elev 508′

Tower may clear for take-off rwy 18L from taxiway 2W-9375′ is available.

2W GENERAL AVIATION 2E

Elev 575′ CONTROL TOWER 799′

16S 174°

3W 3E ARP

4000′

Restricted to acft 12,500 lbs or less and STOL acft.

4E

Elev 573′

36S 354°

SATELLITE

11,387′

11,388′

11,388′

36L 354° Elev 582′

Elev 576′ 36R 354°

35L 354° Elev 563′

35R 354° Elev 562′

INNER OUTER

TAXIWAY 50′ WIDE
MAX GWT 12,500 LBS.

LLWAS

NW NE W CF SW SE

Feet 0 1000 2000 3000 4000 5000

Meters 0 500 1000 1500

CHANGES: Ramp.

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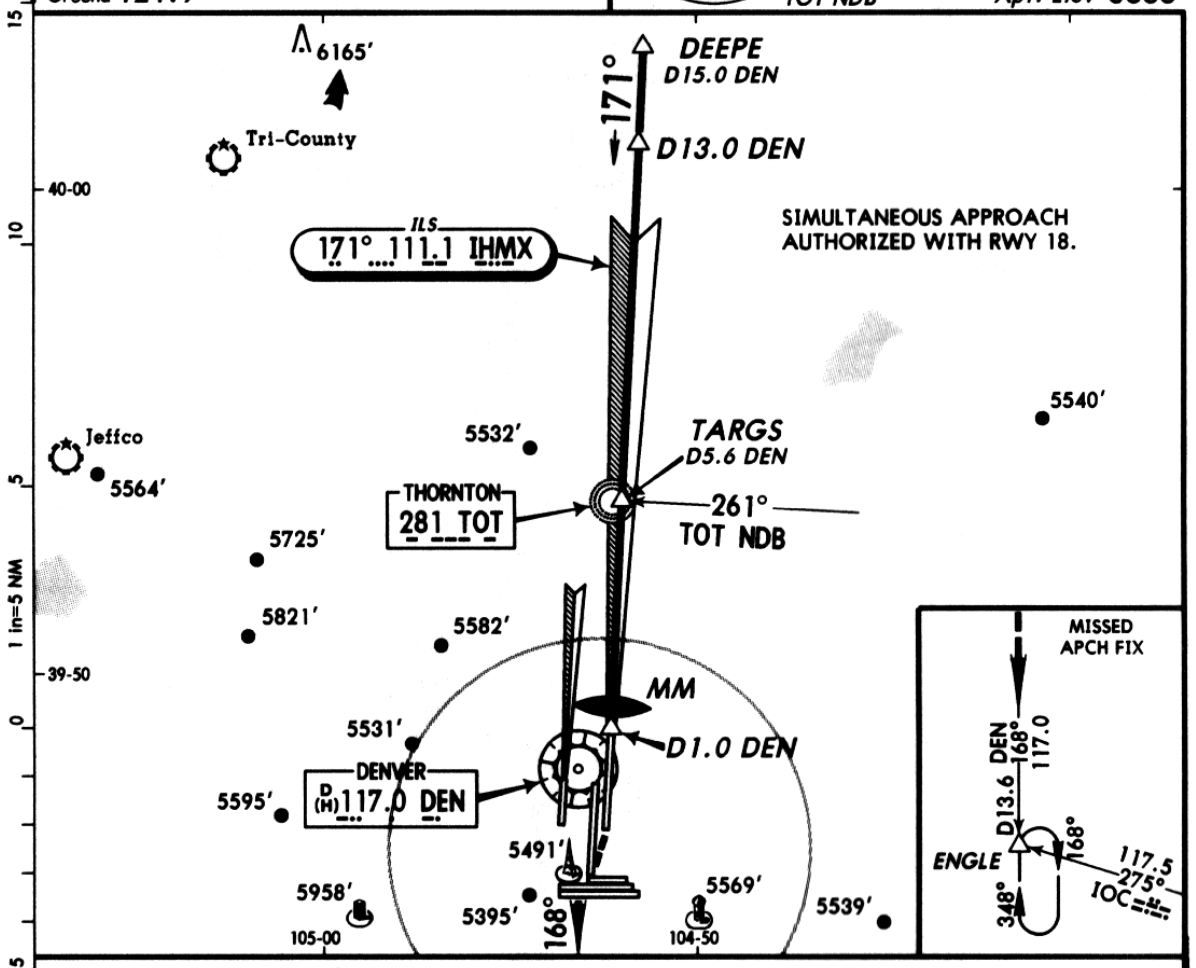
JEPPESEN JUN 24-88 (11-4) Eff Jun 30

DENVER, COLO
STAPLETON INTL
ILS DME-1 Rwy 17L

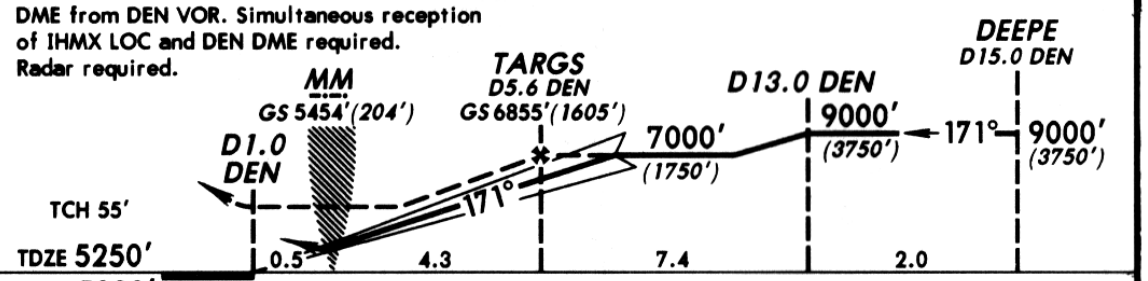
ATIS Arrival 125.6
DENVER Approach (R) North 120.2
South 120.8
Final 125.3
DENVER Tower North & South 119.5
East & West 118.3
Ground 121.9

LOC 111.1 IHMX
Apt. Elev 5333'

MSA
TOT NDB
145° 7800' 11,600' 355°



DME from DEN VOR. Simultaneous reception of IHMX LOC and DEN DME required.
Radar required.



APT. 5333'

MISSED APPROACH: Climb to 9000' outbound via DEN VOR R-168 to ENGLE INT/ D13.6 DEN and hold.

STRAIGHT-IN LANDING RWY 17L	ILS			LOC (GS out)				CIRCLE-TO-LAND
	DH 5450'(200')		DH 5500'(250')	MDA 5580'(330')				MDA
	FULL	RAIL or ALS out	MM out		MM out	RAIL out	ALS out	
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2		RVR 40 or 3/4	RVR 50 or 1	A 5860'(527')-1
B								B 5880'(547')-1
C								C 5880'(547')-1 1/2
D			RVR 40 or 3/4	RVR 40 or 3/4	RVR 50 or 1			D 5900'(567')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	646	754	862
MAP at D1.0 or TARGS to MAP	4.8	4:07	3:12	2:53	2:24	2:03	1:48

AMEND 6

CHANGES: D15.0 fix named Deepe .

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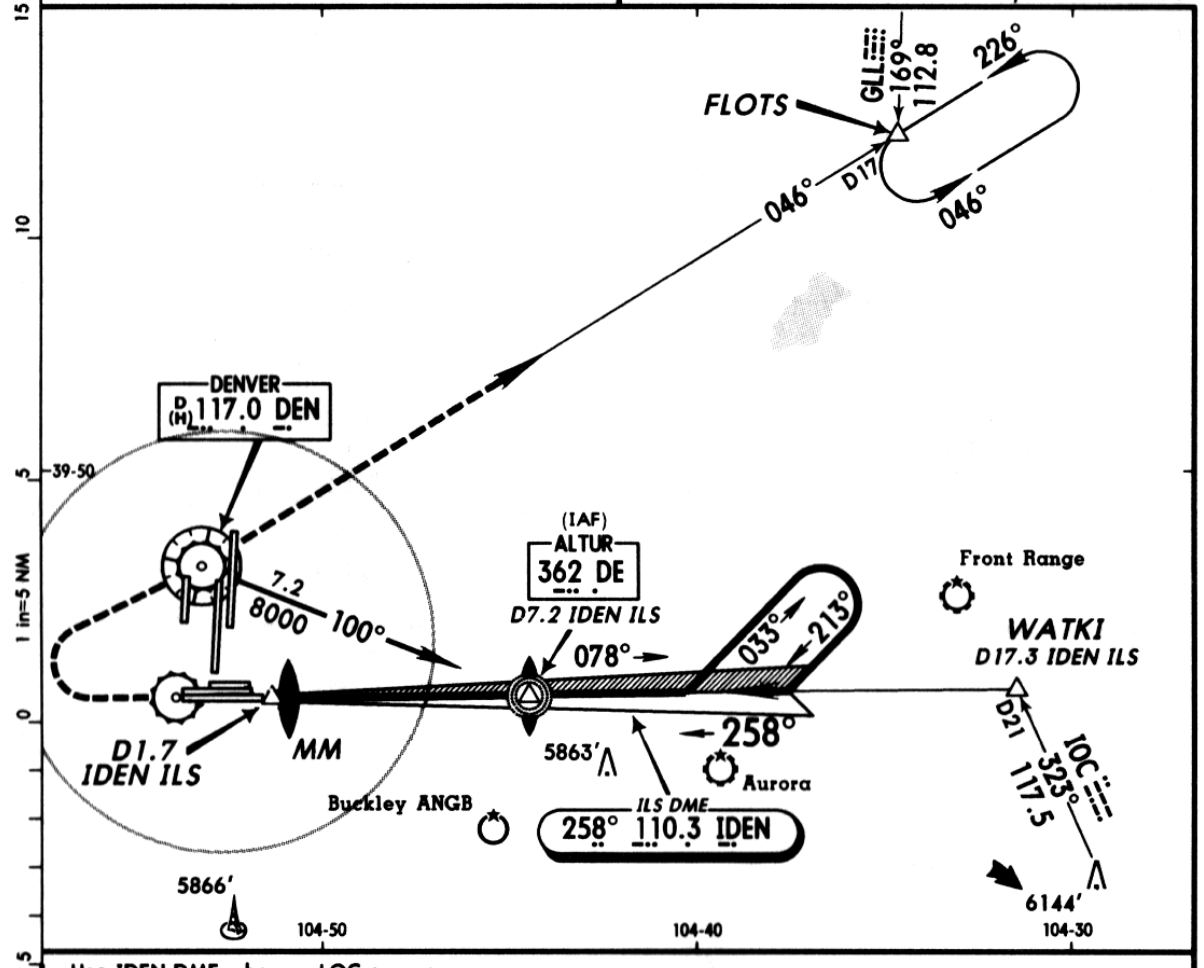
JEPPESEN MAY 11-90 (11-3)

DENVER, COLO
STAPLETON INTL
ILS Rwy 26L

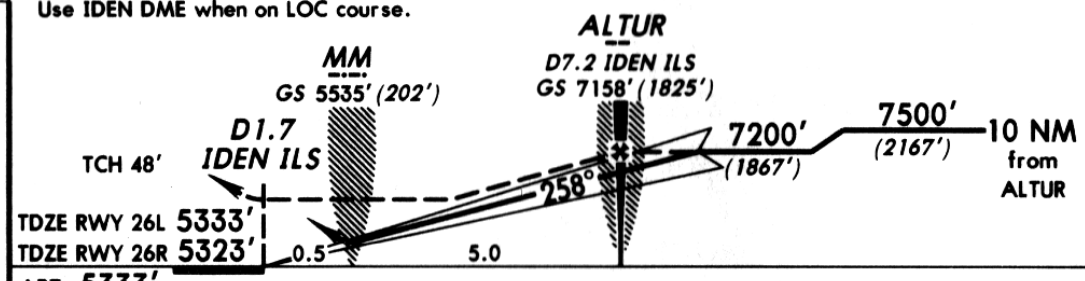
ATIS Arrival 125.6
DENVER Approach (R) North 120.2
South 120.8
Final 125.3
DENVER Tower North & South 119.5
East & West 118.3
Ground 121.9

LOC 110.3 IDEN
Apt. Elev 5333'

MSA
DE LOM
160° 8100' 10,500' 345°



Use IDEN DME when on LOC course.



APT. 5333'

MISSED APPROACH: Climb to 6500' then climbing RIGHT turn to 10000' direct DEN VOR then outbound via DEN VOR R-046 to FLOTS INT/D17.0 and hold.

STRAIGHT-IN LANDING RWY 26L	ILS			LOC (GS out)				SIDESTEP LANDING RWY 26R	CIRCLE-TO-LAND	
	DA(H) 5533'(200')		DA(H) 5583'(250')	MDA(H) 5800'(467')				MDA(H) 5800'(477')	Max Kts	MDA(H)
	FULL	RAIL or ALS out	MM out		RAIL out	ALS out				
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1		1	90	5880'(547')-1
B									120	
C				RVR 40 or 3/4	RVR 60 or 1 1/4			1 1/2	140	5880'(547')-1 1/2
D			RVR 40 or 3/4	RVR 50 or 1	1 1/2			2	165	5900'(567')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
MAP at D1.7 IDEN or ALTUR to MAP	5.5	4:43	3:40	3:18	2:45	2:21	2:04

AMEND 46

CHANGES: See other side.

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JEPPESEN OCT 6-89 (10-9)

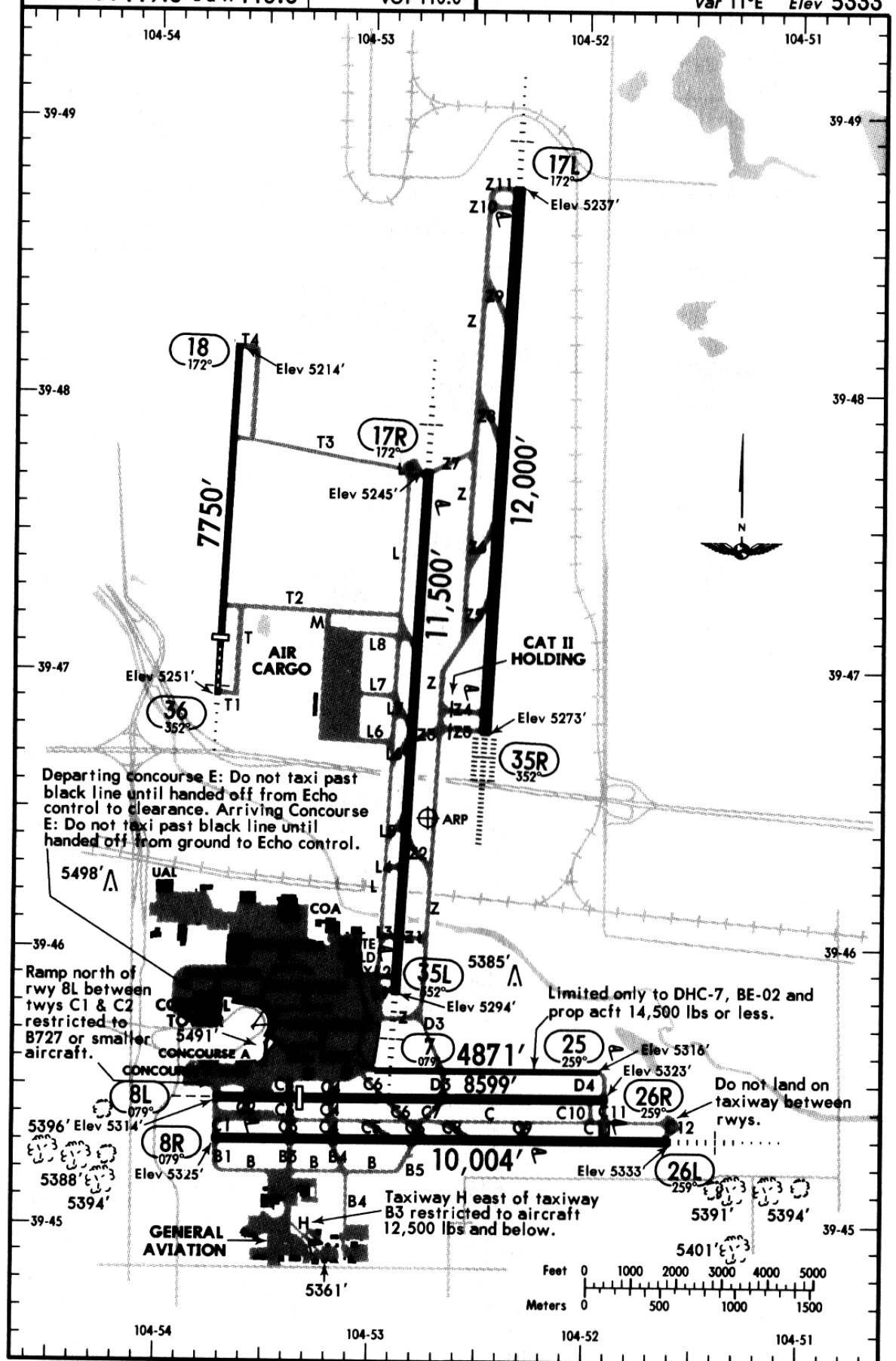
AIRPORT

KDEN DENVER, COLO STAPLETON INTL

ATIS Departure 124.45
DENVER Clearance (Cpt) 127.6
Ground 121.9
Tower N & S 119.5 E & W 118.3

DENVER Departure (R)
275°-118° 128.05
119°-274° 123.85
VOT 110.0

DEN 117.0-On Airport N39 46.5 W104 52.8
Var 11°E *Elev* 5333′



CHANGES: Airport notes.

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JEPPESEN JUN 16-89 (11-1A)

DETROIT, MICH -METRO WAYNE CO

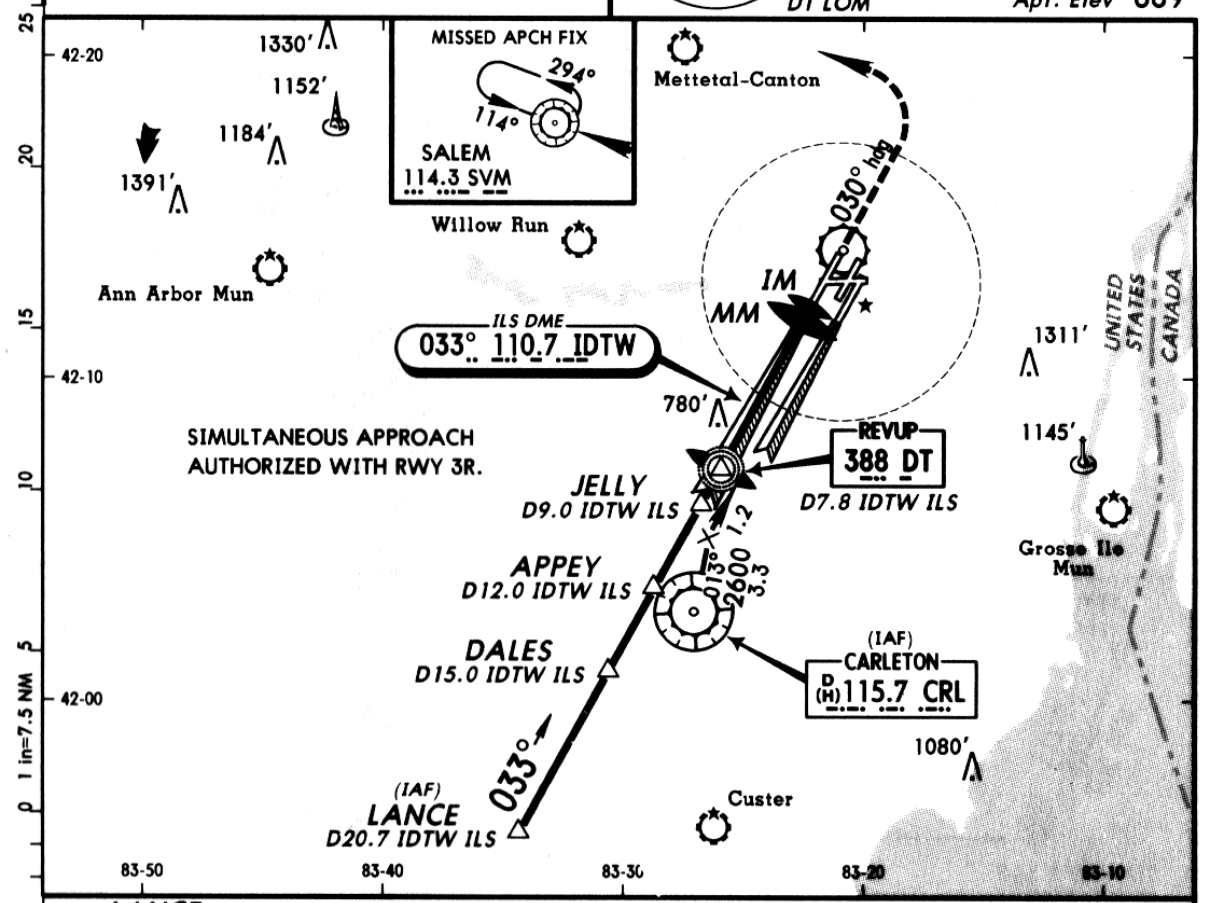
ILS Rwy 3L CAT II&III

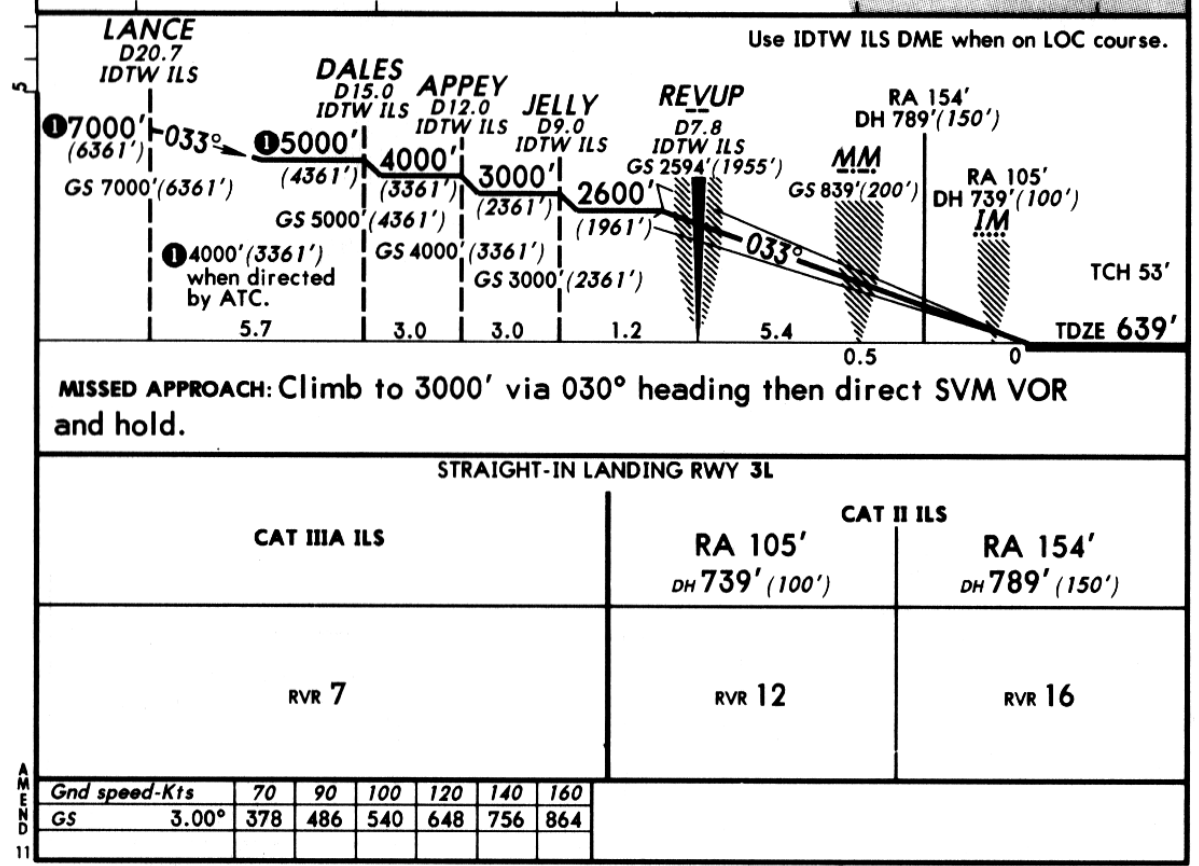
Special Aircrew & Acft Certification Required

ATIS 124.55
DETROIT Approach (R) 124.05
METRO Tower (East) 118.4 (West) 135.0
Ground (East) 119.45 (West) 121.8

3100′ MSA DT LOM

LOC 110.7 IDTW
Apt. Elev 639′





MISSED APPROACH: Climb to 3000′ via 030° heading then direct SVM VOR and hold.

STRAIGHT-IN LANDING RWY 3L

CAT IIIA ILS	CAT II ILS	
	RA 105′ DH 739′ (100′)	RA 154′ DH 789′ (150′)
RVR 7	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864

AMEND 11

CHANGES: See other side.

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JEPPESEN JUN 16-89 (11-2A)

DETROIT, MICH
-METRO WAYNE CO
ILS Rwy 3R CAT II

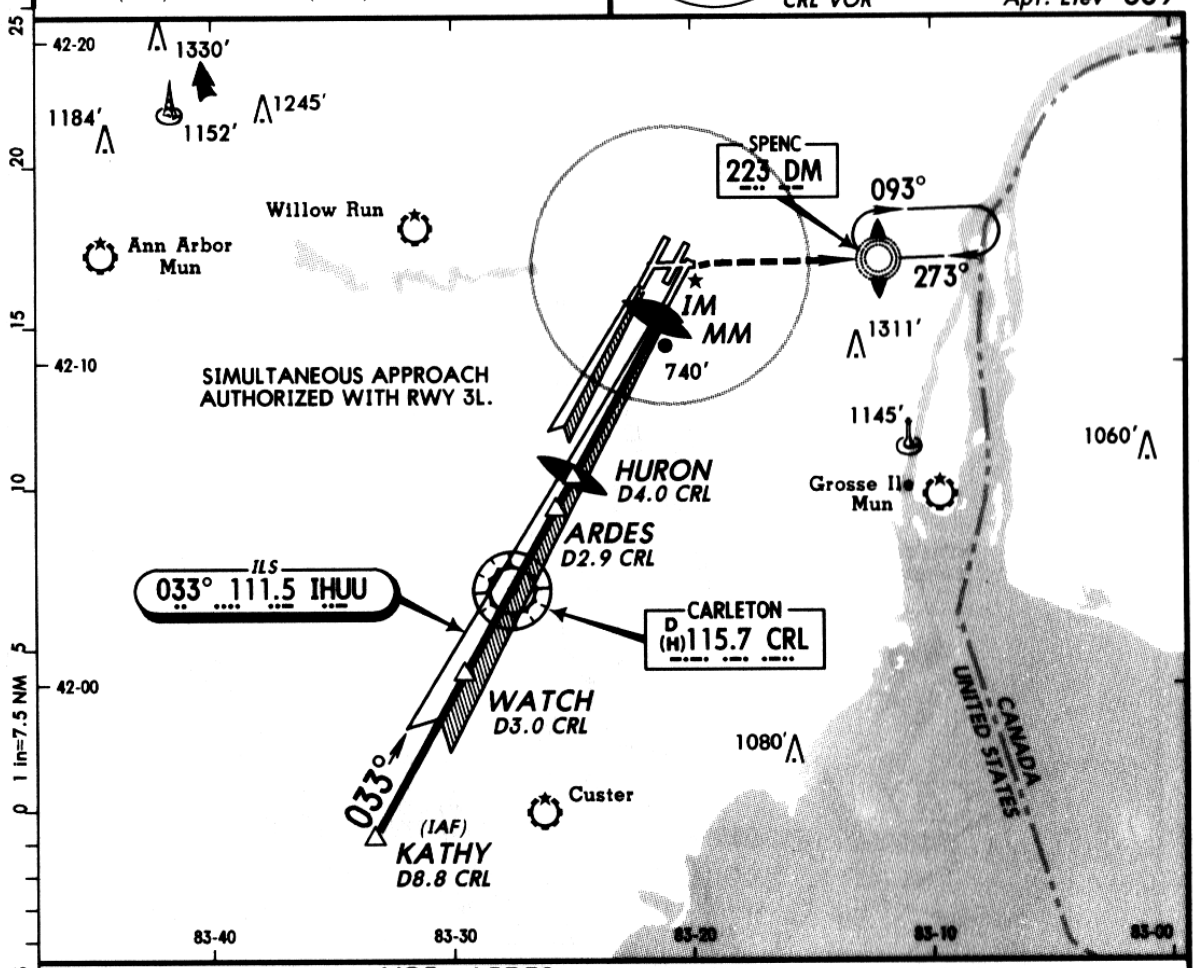
Special Aircrew & Acft Certification Required

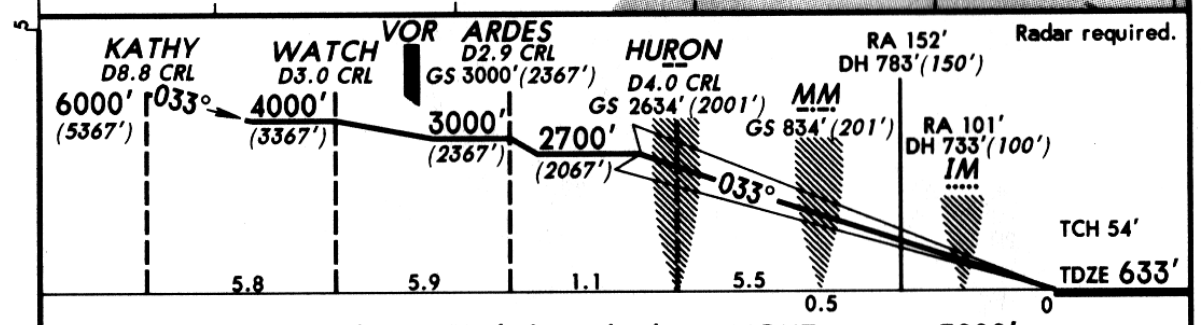
LOC 111.5 IHUU

Apt. Elev 639'

ATIS 124.55
DETROIT Approach (R) 124.05
METRO Tower (East) 118.4 (West) 135.0
Ground (East) 119.45 (West) 121.8

3100' MSA CRL VOR





MISSED APPROACH: Climb to 1100' then climbing RIGHT turn to 3000' direct DM LOM and hold.

STRAIGHT-IN LANDING RWY 3R
CAT II ILS

RA 101'	RA 152'
DH 733'(100')	DH 783'(150')
RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	487	541	649	757	865

AMEND 11

CHANGES: See other side.

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JEPPESEN DEC 9-88 (11-5) Eff Dec 15

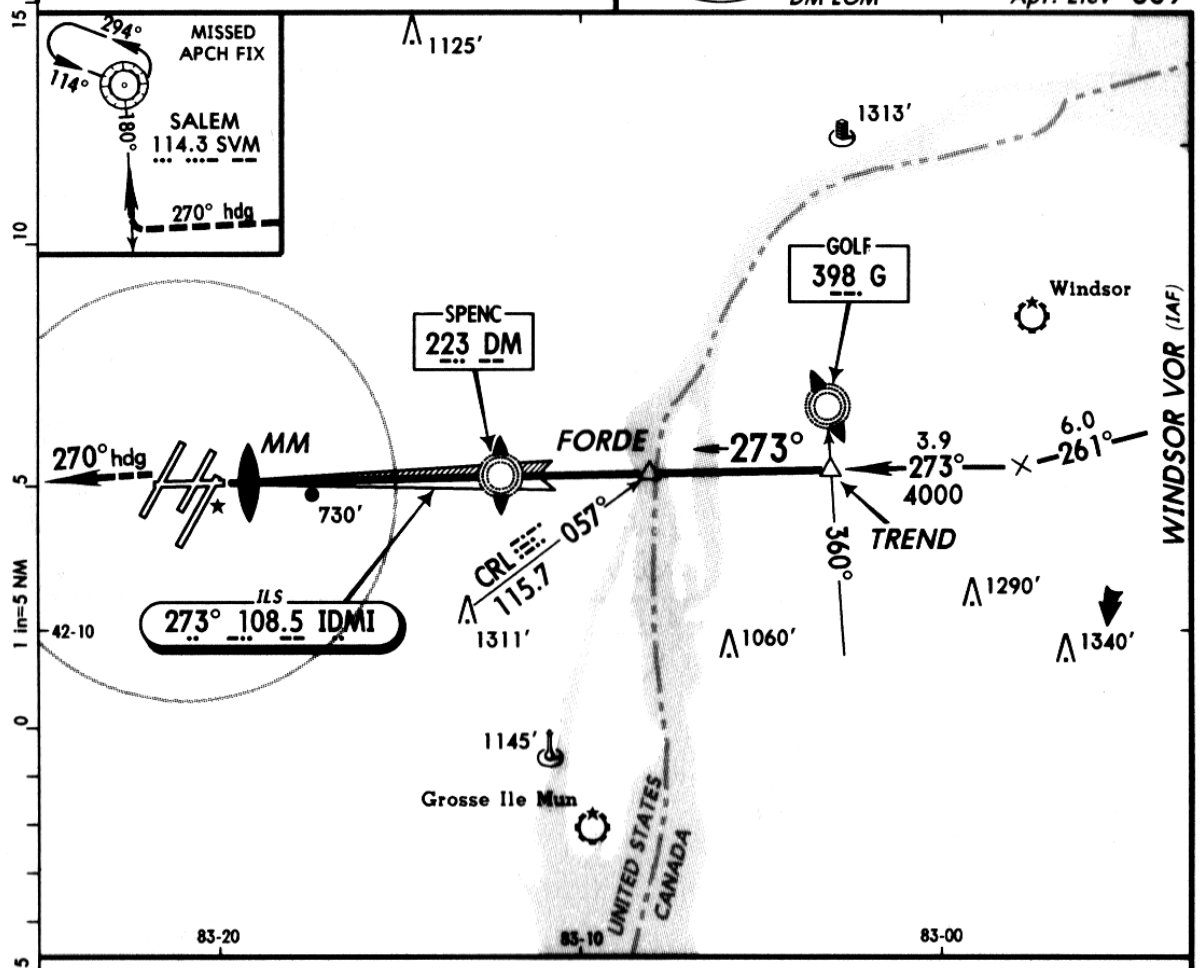
DETROIT, MICH
-METRO WAYNE CO
ILS Rwy 27

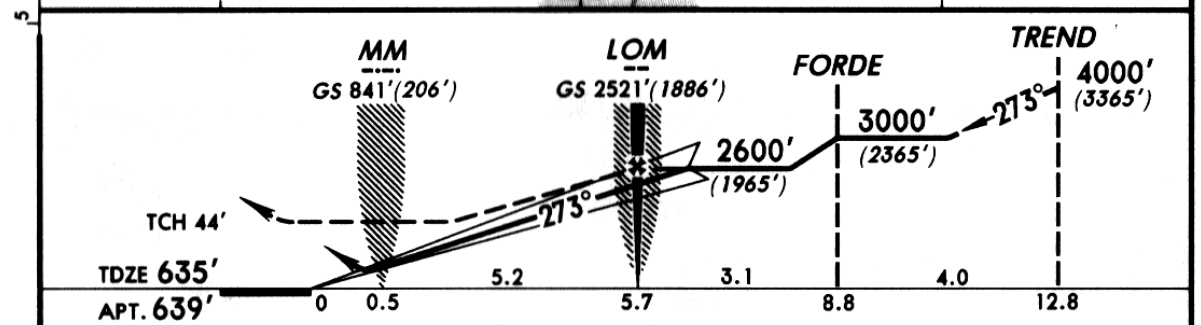
LOC 108.5 IDMI

Apt. Elev 639'

ATIS 124.55
DETROIT Approach (R) 124.05
METRO Tower (East) 118.4 (West) 135.0
Ground (East) 119.45 (West) 121.8

2800' MSA DM LOM





MISSED APPROACH: Climb to 3000' via 270° heading and inbound SVM VOR R-180 to SVM VOR and hold .

STRAIGHT-IN LANDING RWY 27

	ILS			LOC (GS out)			
	DH 835' (200')		DH 885' (250')	MDA 980' (345')			
	FULL	RAIL or ALS out	MM out		MM out	RAIL out	ALS out
A	1/2	3/4	1/2	1/2		3/4	1
B							
C							
D			3/4	3/4	1	1 1/4	

CIRCLE-TO-LAND

	MDA
A	1100'(461')-1
B	1100'(461')-1 1/2
C	
D	1200'(561')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
LOM to MAP	5.7	4:53	3:48	3:25	2:51	2:27	2:08

AMEND 7

CHANGES: Reverse side (VOR Rwy 9) cancelled.

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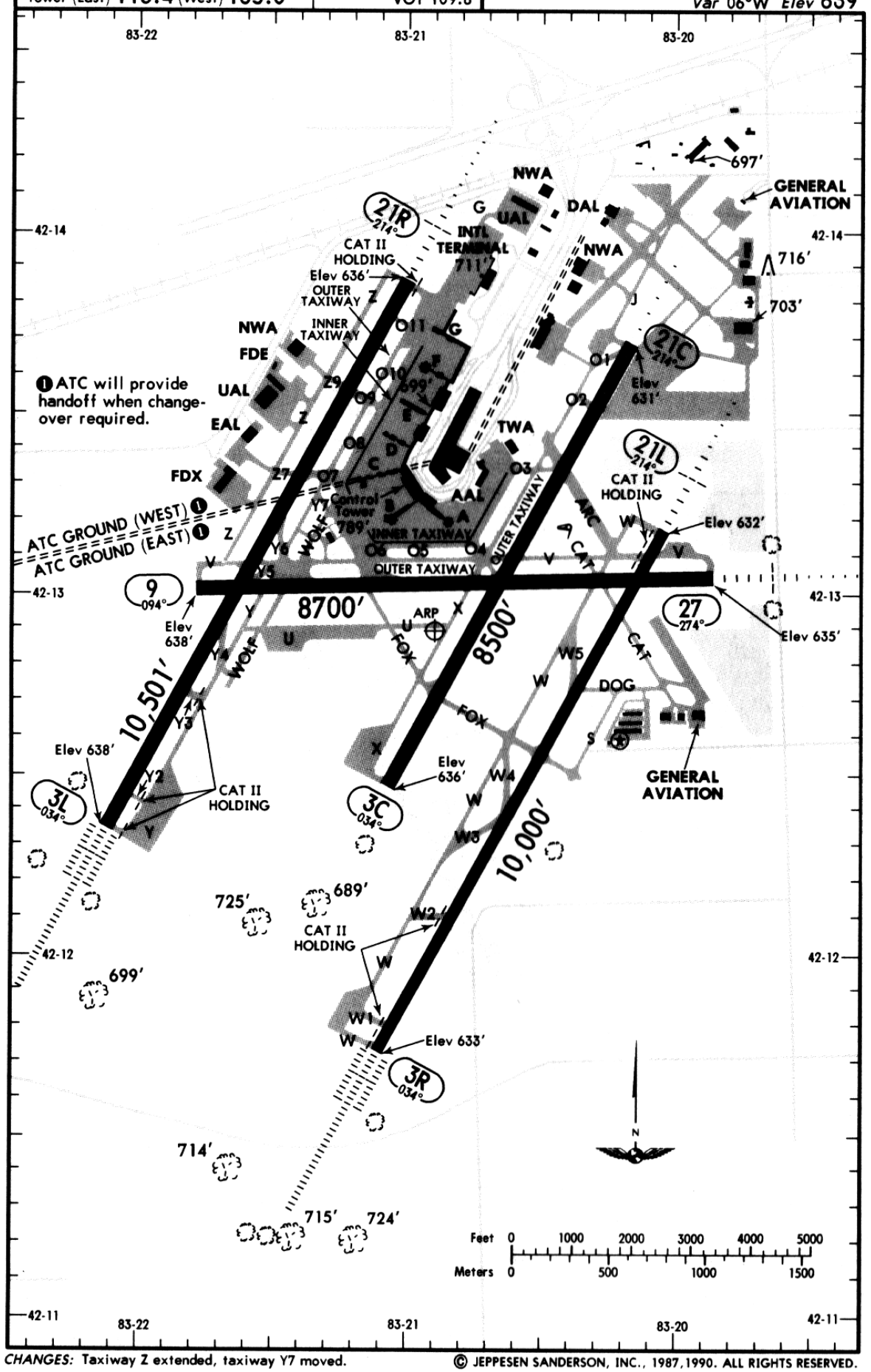
JEPPESEN JAN 12-90 (10-9) KDTW AIRPORT

DETROIT, MICH
-METRO WAYNE CO

ATIS 124.55
METRO Clearance (Cpt) 120.65
Ground (East) 119.45 (West) 121.8
Tower (East) 118.4 (West) 135.0

DETROIT Departure (R)
(East) 132.02
(West) 125.52
VOT 109.8

DXO 113.4 - On Airport N42 12.9 W083 20.9
Var 06°W Elev 639'



CHANGES: Taxiway Z extended, taxiway Y7 moved.

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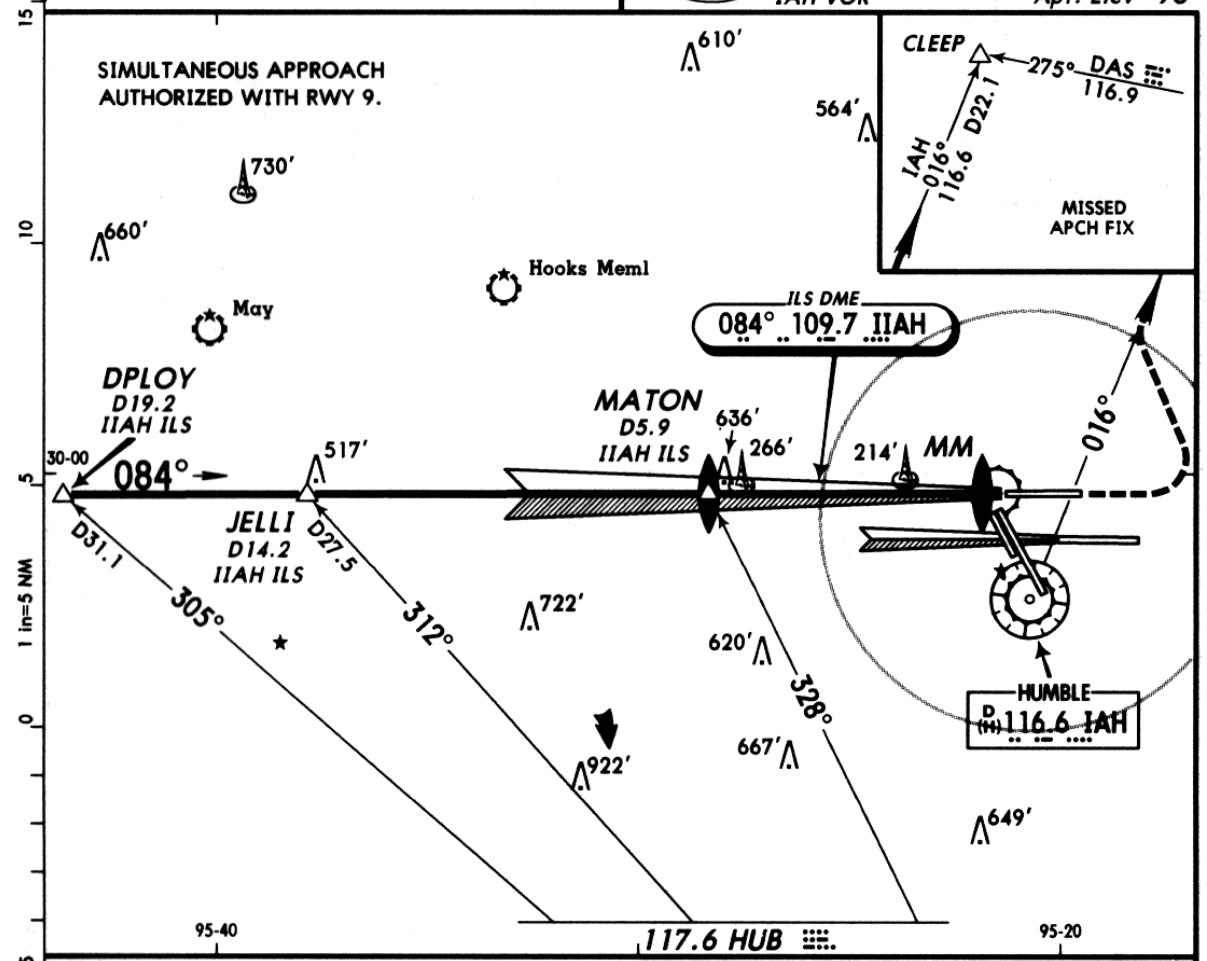
JEPPESEN JAN 5-90 (71-3) Eff Jan 11

HOUSTON, TEXAS
HOUSTON INTERCONTINENTAL
ILS Rwy 8

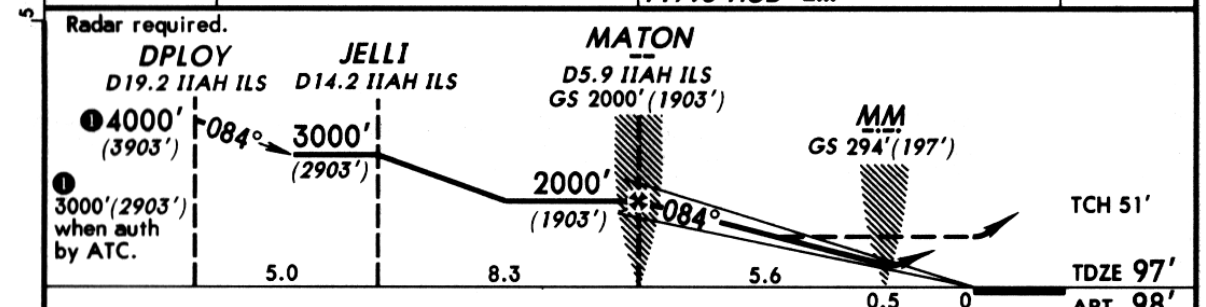
ATIS 124.05
HOUSTON Approach (R) 120.05
HOUSTON Tower 118.1
Ground 121.7

2400'
040° 290°
3100'
MSA
IAH VOR

LOC 109.7 IIAH
Apt. Elev 98'



Radar required.



MISSED APPROACH: Climb to 1000' then climbing LEFT turn to 2300' outbound via IAH VOR R-016 to CLEEP INT.

STRAIGHT-IN LANDING RWY 8

	ILS DA(H) 297'(200') FULL	ILS DA(H) 297'(200') TDZ or CL out	ILS DA(H) 297'(200') RAIL or ALS out	ILS DA(H) 347'(250') MM out	LOC (GS out) MDA(H) 480'(383')			CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
						RAIL out	ALS out		
A	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	90	700'(602') - 1
B								120	
C								140	700'(602') - 1 3/4
D				RVR 40 or 3/4	RVR 40 or 3/4	RVR 60 or 1 1/4		165	700'(602') - 2

Gnd speed-Kts		70	90	100	120	140	160
GS	2.80°	354	455	505	607	708	809
MATON to MAP	6.1	5:14	4:04	3:40	3:03	2:37	2:17

AMEND 18

CHANGES: Procedure.

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JEPPESEN JAN 5-90 71-4 Eff Jan 11

HOUSTON, TEXAS

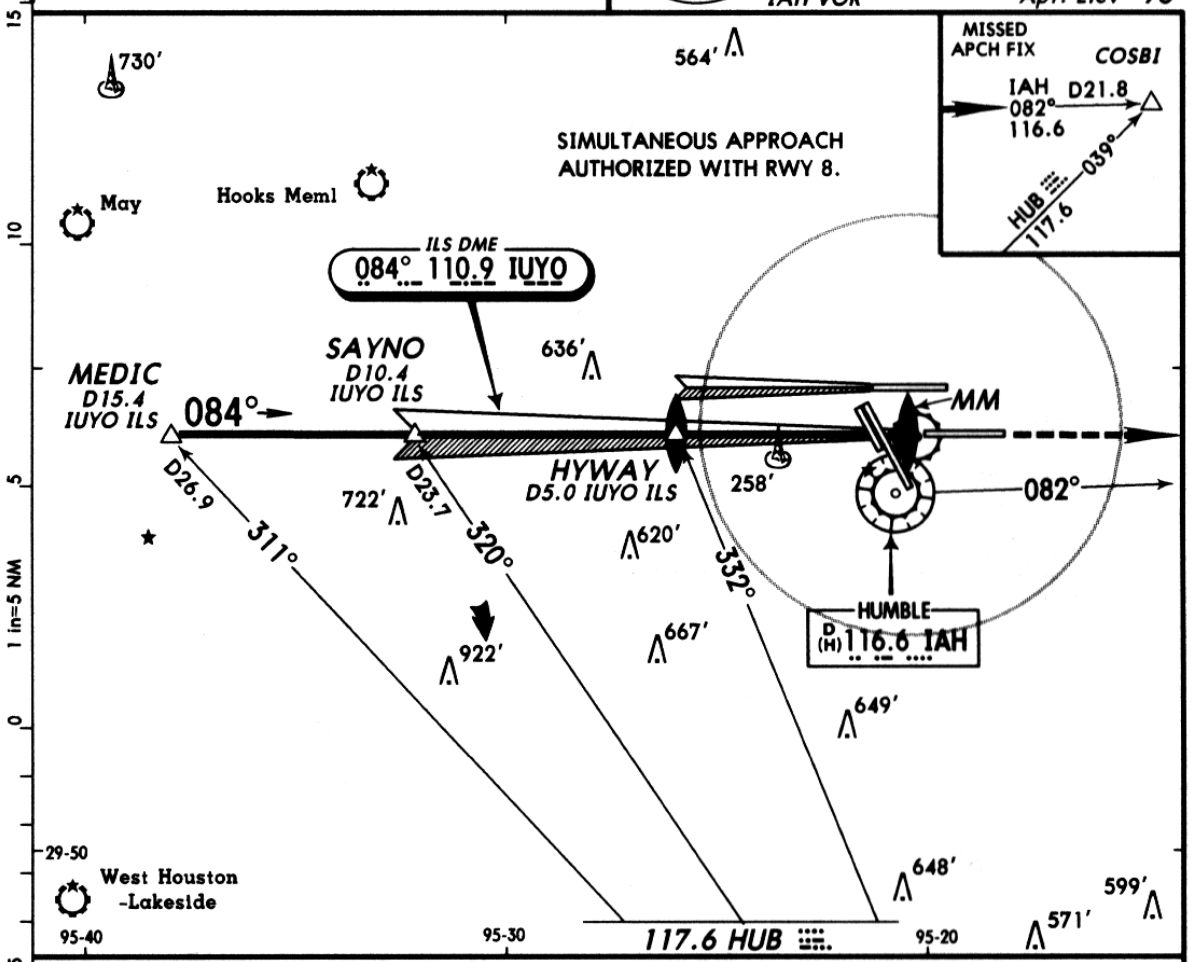
HOUSTON INTERCONTINENTAL

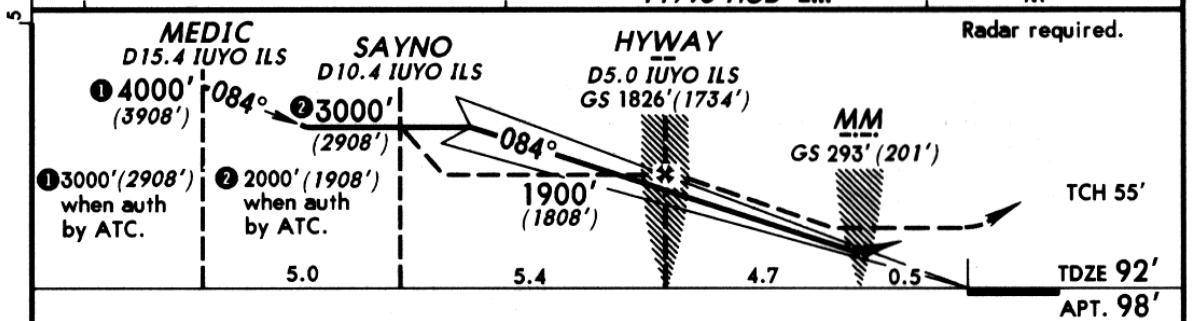
ILS Rwy 9

ATIS 124.05
HOUSTON Approach (R) 120.05
HOUSTON Tower 118.1
Ground 121.7

LOC 110.9 IUYO

MSA IAH VOR: 2400′ (040°–290°), 3100′
Apt. Elev 98′





MISSED APPROACH: Climb to 2000′ then RIGHT turn outbound via IAH VOR R-082 to COSBI INT.

STRAIGHT-IN LANDING RWY 9	ILS				LOC (GS out)			CIRCLE-TO-LAND	
	DA(H) 292′(200′)			DA(H) 342′(250′)	MDA(H) 520′(428′)				
	FULL	TDZ or CL out	RAIL or ALS out	MM out		RAIL out	ALS out	Max Kts	MDA(H)
A	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	90	700′(602′)-1
B								120	
C					RVR 40 or ¾	RVR 60 or 1¼		140	700′(602′)-1¾
D				RVR 40 or ¾	RVR 50 or 1	1½		165	700′(602′)-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	538	646	754	861
HYWAY to MAP	5.2	4:27	3:28	3:07	2:36	2:14	1:57

AMEND 3

CHANGES: Procedure.

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JEPPESEN JAN 5-90 71-5 Eff Jan 11

HOUSTON, TEXAS

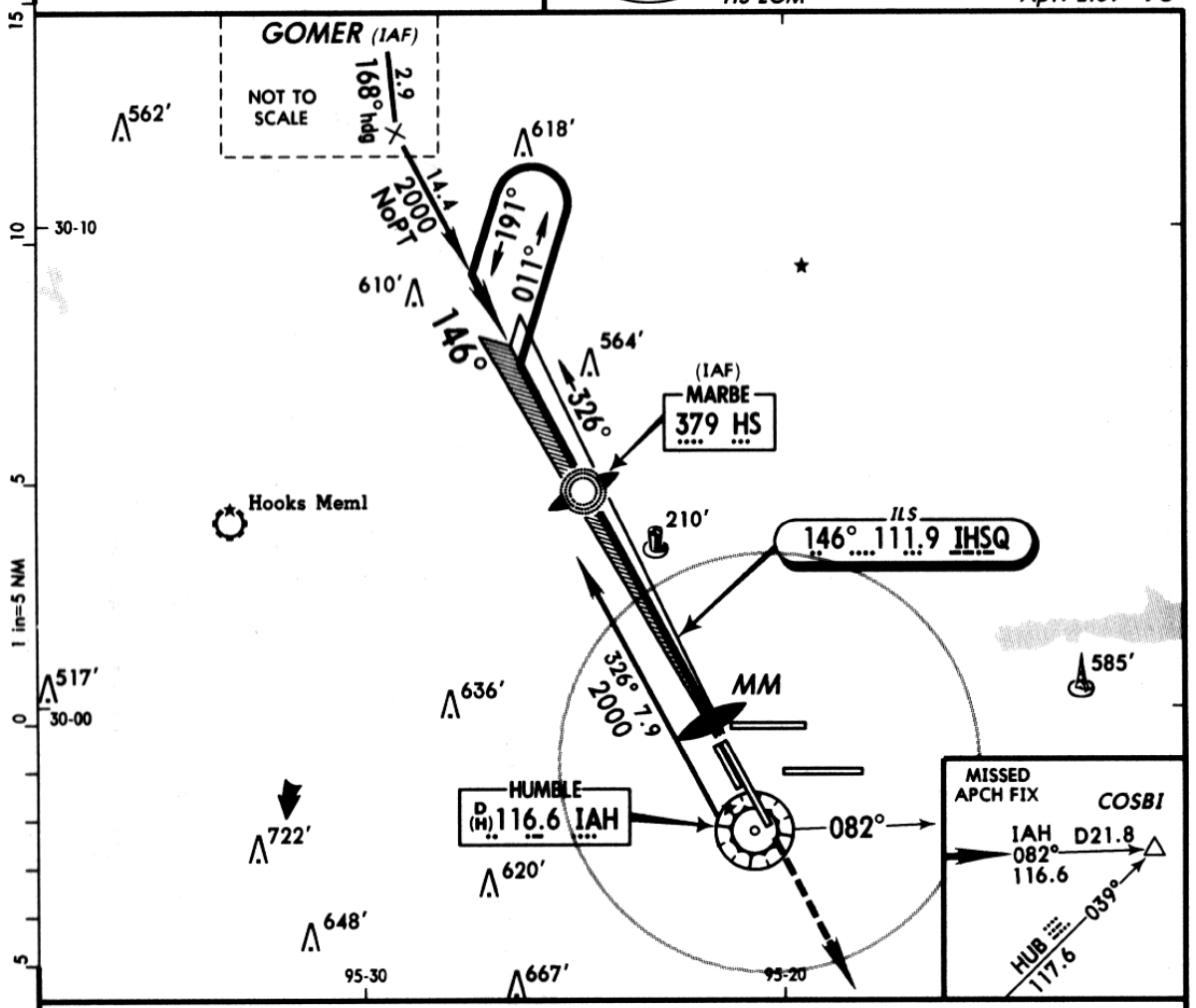
HOUSTON INTERCONTINENTAL

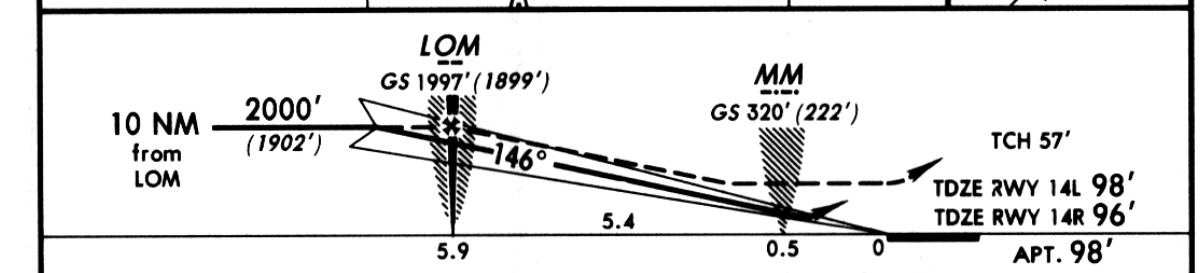
ILS Rwy 14L

ATIS 124.05
HOUSTON Approach (R) 120.05
HOUSTON Tower 118.1
Ground 121.7

LOC 111.9 IHSQ

MSA HS LOM: 2400′
Apt. Elev 98′





MISSED APPROACH: Climb to 2000′ then LEFT turn outbound via IAH VOR R-082 to COSBI INT.

STRAIGHT-IN LANDING RWY 14L	ILS			LOC (GS out)			SIDESTEP LANDING RWY 14R	CIRCLE-TO-LAND	
	DA(H) 298′(200′)		DA(H) 348′(250′)	MDA(H) 460′(362′)			MDA(H) 460′(364′)		
	FULL	RAIL or ALS out	MM out		RAIL out	ALS out		Max Kts	MDA(H)
A	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	1	90	700′(602′)-1
B								120	
C							1½	140	700′(602′)-1¾
D			RVR 40 or ¾	RVR 40 or ¾	RVR 60 or 1¼		2	165	700′(602′)-2

Gnd speed-Kts		70	90	100	120	140	160
GS	2.87°	362	466	518	621	725	828
LOM to MAP	5.9	5:03	3:56	3:32	2:57	2:32	2:13

AMEND 9

CHANGES: DME arcs removed, minimums.

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JEPPESEN JAN 5-90 (71-2A) Eff Jan 11

HOUSTON, TEXAS
HOUSTON INTERCONTINENTAL
ILS Rwy 27 CAT II

Special Aircrew & Acft Certification Required

LOC 110.9 IGHI

Apt. Elev 98′

ATIS 124.05
HOUSTON Approach (R) 120.05
HOUSTON Tower 118.1
Ground 121.7

MSA IAH VOR
2400′ 290° 040° 3100′

SIMULTANEOUS APPROACH AUTHORIZED WITH RWY 26.

ILS DME 264° 110.9 IGHI

564′ 569′ 585′ 200′ 530′ 596′

FESTA D10.0 IGHI ILS
DENTO D14.5 IGHI ILS
TRANN D19.5 IGHI ILS
TANKS D6.0 IGHI ILS
IM
MM
HUMBLE (H) 116.6 IAH
251° 264° 003° 014° 024° 034°
D20.8 D22.7 D25.6
1 in=5 NM

TNV 115.9 159°
D31.8 IAH 251° 116.6
SEALY
284° HUB 117.6
MISSED APCH FIX

117.6 HUB 95-00

Radar required.

	MM	TANKS	FESTA	DENTO	TRANN
		D6.0 IGHI ILS	D10.0 IGHI ILS	D14.5 IGHI ILS	D19.5 IGHI ILS
	GS 288′(201′)	GS 1491′(1404′)			
RA 155′ DA(H)237′(150′)				3000′ (2913′)	❶4000′ (3913′)
RA 105′ DA(H)187′(100′)	IM		2000′ (1913′)		
TCH 55′					❶3000′(2913′) when auth by ATC.
TDZE 87′	0	0.5	3.7	4.0	4.5	5.0

264°

MISSED APPROACH: Climb to 2000′ then LEFT turn outbound via IAH VOR R-251 to SEALY INT.

STRAIGHT-IN LANDING RWY 27
CAT II ILS

RA 105′ DA(H) 187′(100′)	RA 155′ DA(H) 237′(150′)
RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	376	484	538	645	753	860

AMEND 1

CHANGES: Procedure.

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JEPPESEN MAY 4-90 (70-9) AIRPORT

KIAH HOUSTON, TEXAS
HOUSTON INTERCONTINENTAL

004.5°/1.4 From IAH 116.6 N29 58.8 W095 20.4
Var 06°E Elev 98′

ATIS 124.05
HOUSTON Clearance 128.1
Ground 121.7
Tower 118.1

HOUSTON Departure (R)
North/East 119.7
West 123.8

CAUTION: Bright lights 1 NM from threshold & 900′ south of centerline rwy 26.

Rwy 8/26 reverse hi-speed turn-offs prohibited.

Expressway lights paralleling rwy 32R may be mistaken for rwy lights on rwy 14L-32R.

9999′ 9401′ 6038′ 12,001′

CAT II HOLD
TERMINALS
SOUTH BRIDGE
EAST BRIDGE
Control Tower 259′
ARP
Elev 85′ Elev 92′ Elev 93′ Elev 96′ Elev 98′ Elev 88′ Elev 91′

Feet 0 1000 500 1000 2000 3000 4000 5000 1500
Meters 0 1000 2000 3000 4000 1000

CHANGES: Ramp.

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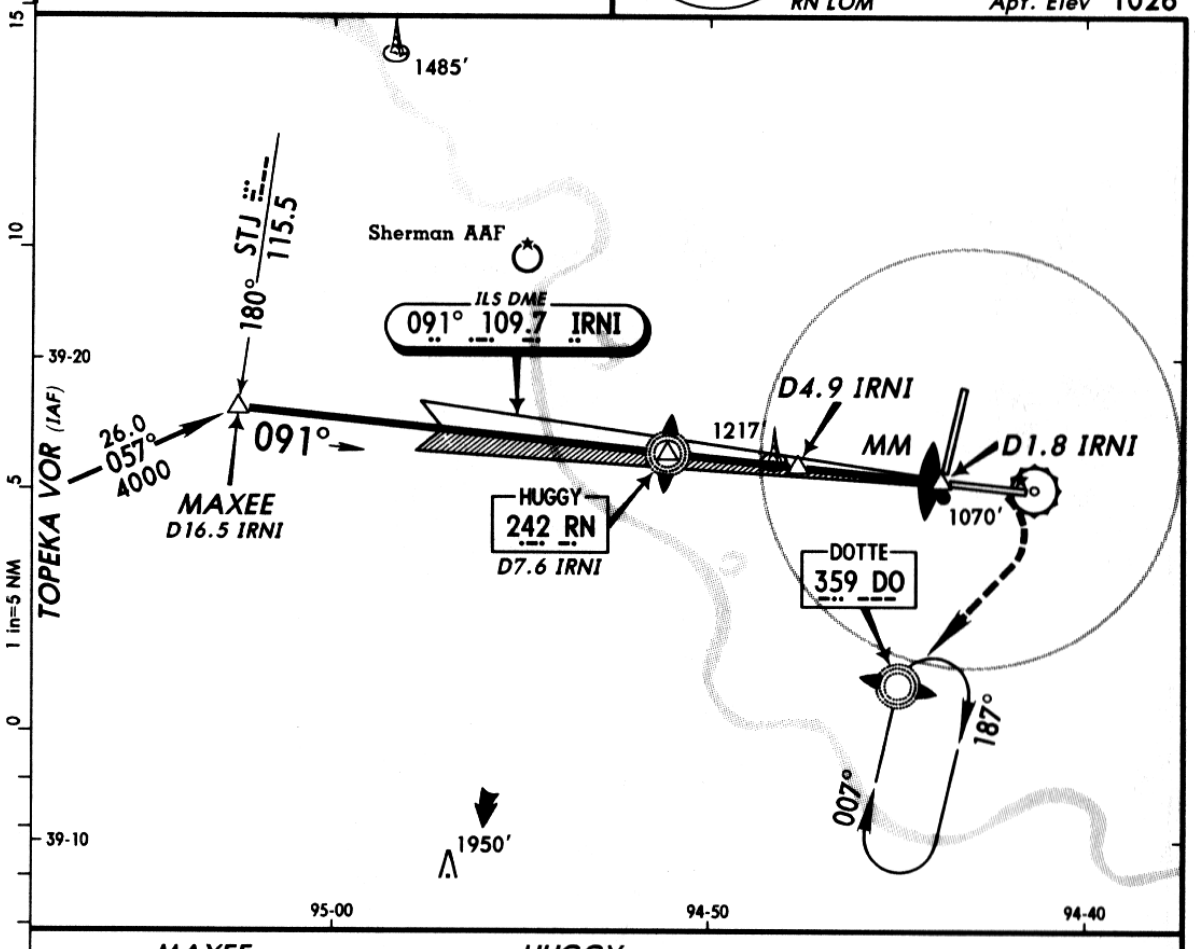
JEPPESEN OCT 6-89 (41-3)

KANSAS CITY, MO
KANSAS CITY INTL
ILS Rwy 9

ATIS 128.35
KANSAS CITY Approach (R) 126.6
INTERNATIONAL Tower 128.2
Ground 121.8

MSA RN LOM: 135°–045° 2700′ / 3100′

LOC 109.7 IRNI
Apt. Elev 1026′



MISSED APPROACH: Climb to 1500′ then climbing RIGHT turn to 4000′ direct DO LOM and hold.

STRAIGHT-IN LANDING RWY 9

	ILS DA(H) 1214′ (200′) FULL	ILS DA(H) 1214′ (200′) RAIL or ALS out	ILS DA(H) 1264′ (250′) MM out	LOC (GS out) MDA(H) 1320′ (306′) With D4.9 IRNI MM out	LOC (GS out) MDA(H) 1320′ (306′) With D4.9 IRNI RAIL out	LOC (GS out) MDA(H) 1320′ (306′) With D4.9 IRNI ALS out	LOC (GS out) MDA(H) 1480′ (466′) Without D4.9 IRNI RAIL out	LOC (GS out) MDA(H) 1480′ (466′) Without D4.9 IRNI ALS out	CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
A	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	RVR 40 or ¾	RVR 50 or 1	90	1540′(514′)-1
B									120	
C							RVR 40 or ¾	RVR 60 or 1¼	140	1540′(514′)-1½
D			RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1		RVR 50 or 1	1½	165	1580′(554′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	378	486	540	648	757	865
MAP at D1.8 IRNI or HUGGY to MAP 5.8	4:58	3:52	3:29	2:54	2:29	2:10

AMEND 10

CHANGES: See other side.

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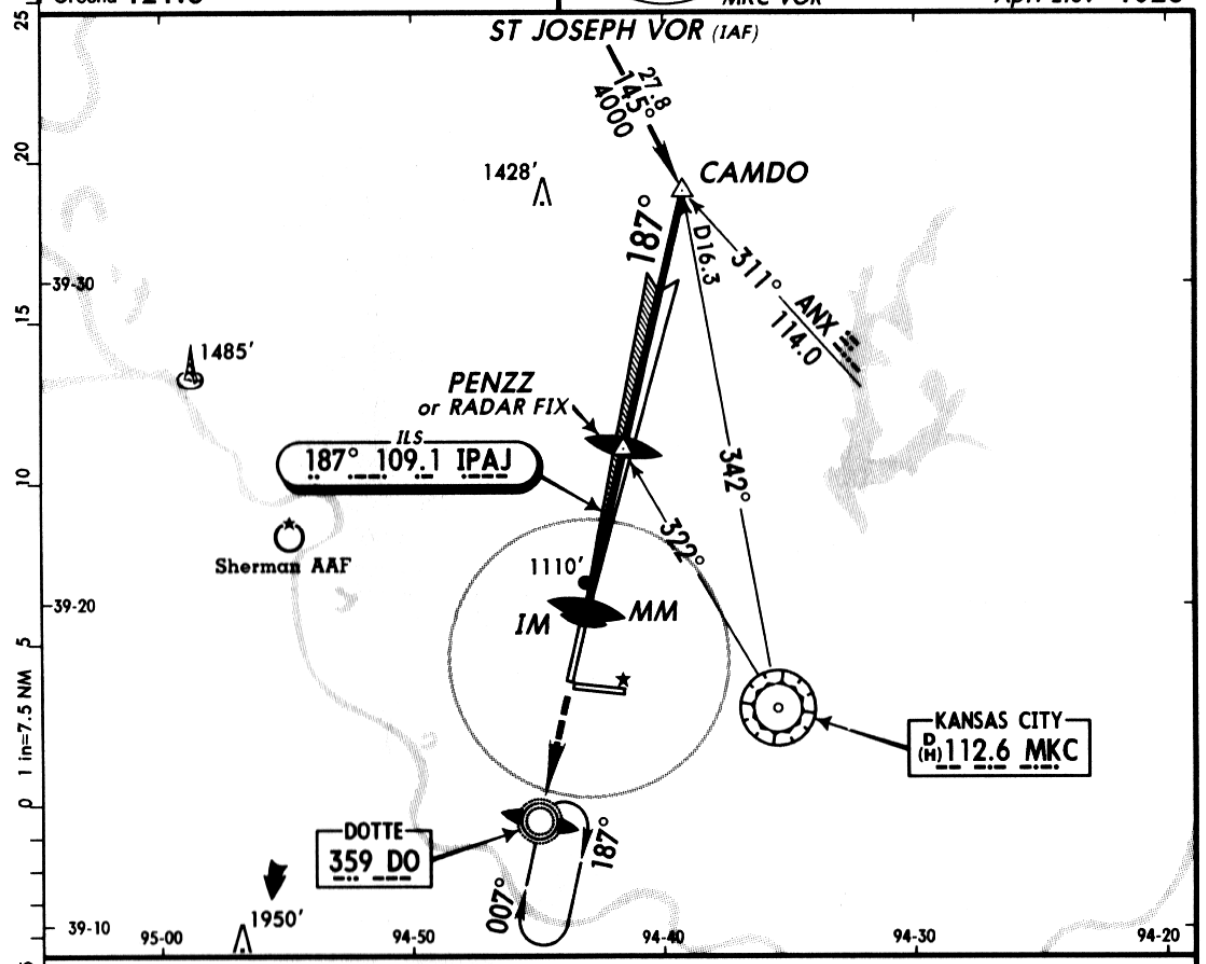
JEPPESEN SEP 8-89 (41-1A)

KANSAS CITY, MO
KANSAS CITY INTL
ILS Rwy 19 CAT II&III
Special Aircrew & Acft Certification Required

ATIS 128.35
KANSAS CITY Approach (R) 126.6
INTERNATIONAL Tower 128.2
Ground 121.8

MSA MKC VOR: 3100′

LOC 109.1 IPAJ
Apt. Elev 1026′



MISSED APPROACH: Climb to 4000′ direct DO LOM and hold.

STRAIGHT-IN LANDING RWY 19

CAT IIIA ILS	CAT II ILS RA 117′ DA(H) 1088′(100′)	CAT II ILS RA 169′ DA(H) 1138′(150′)
RVR 7	RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 6

CHANGES: MSA.

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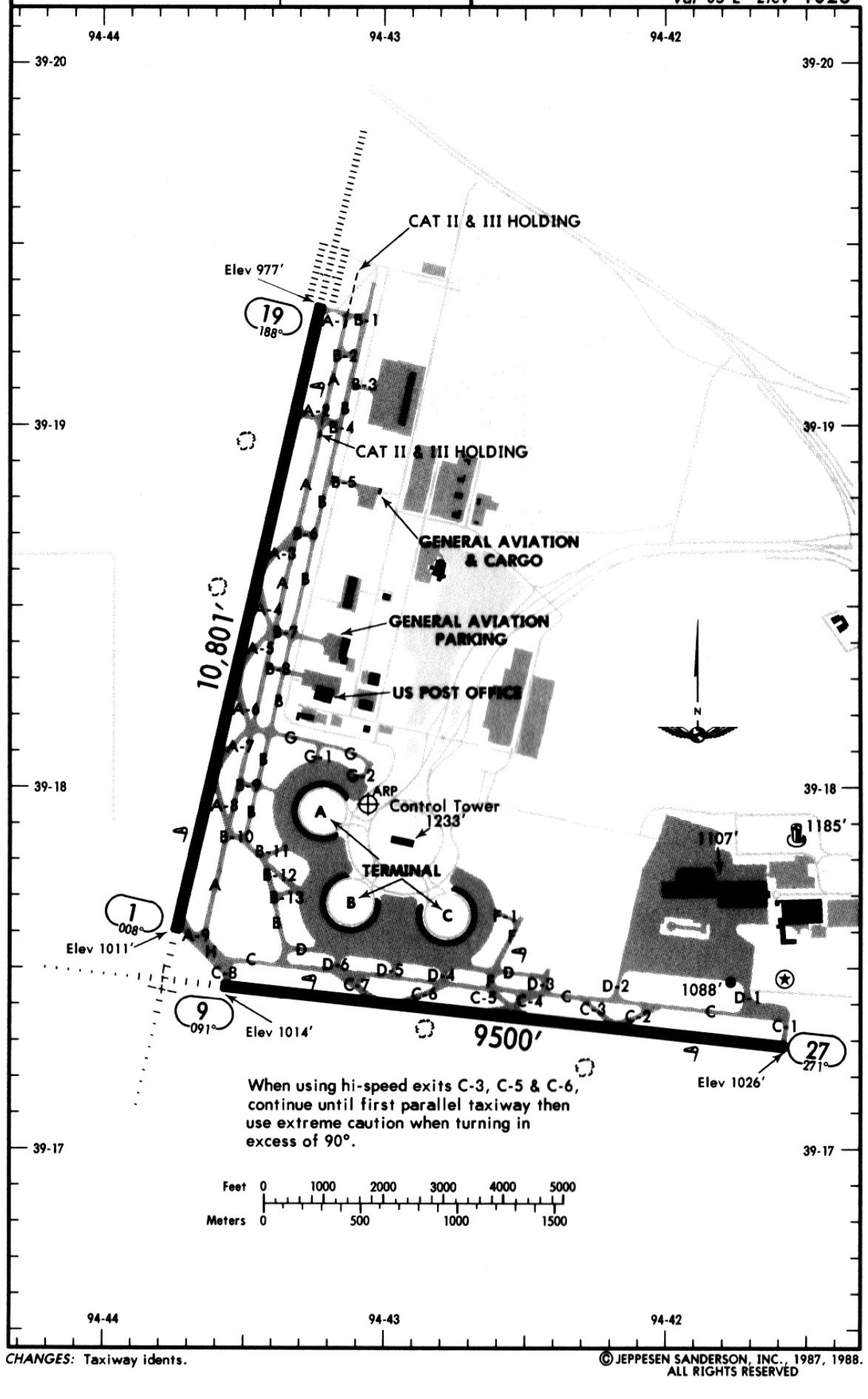
JEPPESEN AUG 19-88 Eff Aug 25 (40-9) KMCI AIRPORT

KANSAS CITY, MO
KANSAS CITY INTL

ATIS 128.35
INTERNATIONAL Clearance 135.7
Ground 121.8
Tower 128.2

KANSAS CITY Departure (R)
191°-009° 124.7
010°-190° 126.6

273.5°/6.0 From MKC 112.6 N39 18.0 W094 43.1
Var 05°E Elev 1026′



CHANGES: Taxiway idents.

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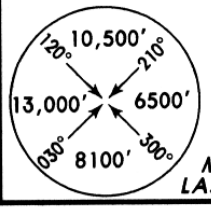
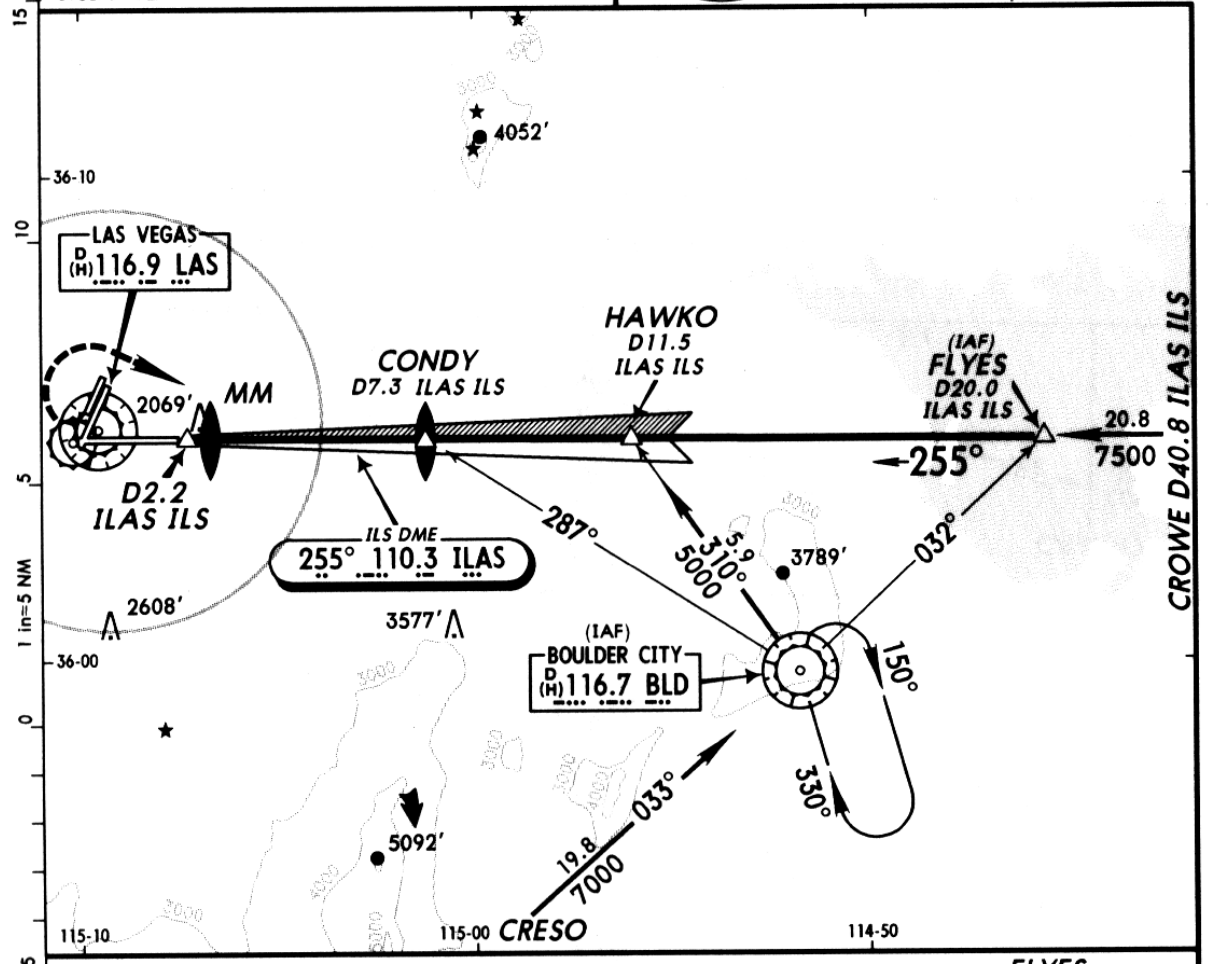
JEPPESEN FEB 2-90 (11-1)

LAS VEGAS, NEV
Mc CARRAN INTL
ILS Rwy 25

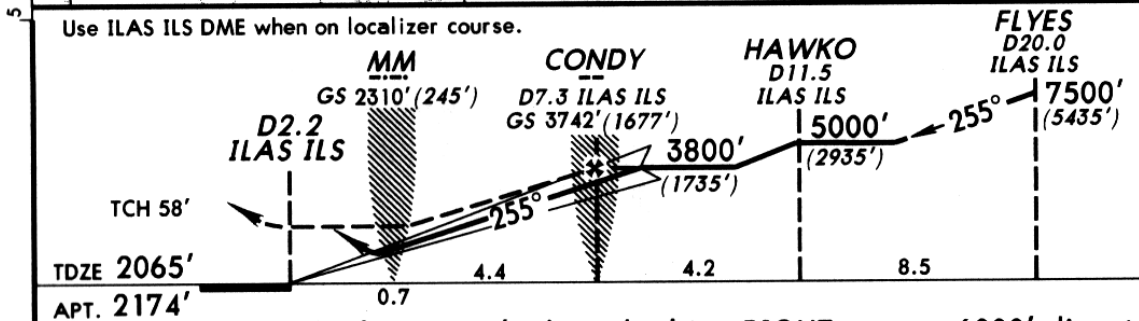
LOC 110.3 ILAS
Apt. Elev 2174′

ATIS Arrival 125.6
LAS VEGAS Approach (R) 127.15
LAS VEGAS Tower 119.9
Ground 121.9





Use ILAS ILS DME when on localizer course.



MISSED APPROACH: Climb to 2800′, then climbing RIGHT turn to 6000′ direct BLD VOR and hold.

STRAIGHT-IN LANDING RWY 25

	ILS DA(H) 2265′ (200′) FULL	ILS DA(H) 2265′ (200′) RAIL or ALS out	ILS DA(H) 2315′ (250′) MM out	LOC (GS out) MDA(H) 2320′ (255′)			CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
				MM out	RAIL out	ALS out		
A	1/2	3/4	1/2	1/2	3/4	1	90	2700′(526′)-1
B							120	
C							140	2740′(566′)-1½
D			3/4	3/4	1		165	2780′(606′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	863
MAP at D2.2 ILAS or CONDY to MAP 5.1	4:22	3:24	3:04	2:33	2:11	1:55

AMEND 12

CHANGES: Cat C circling MDA(H).

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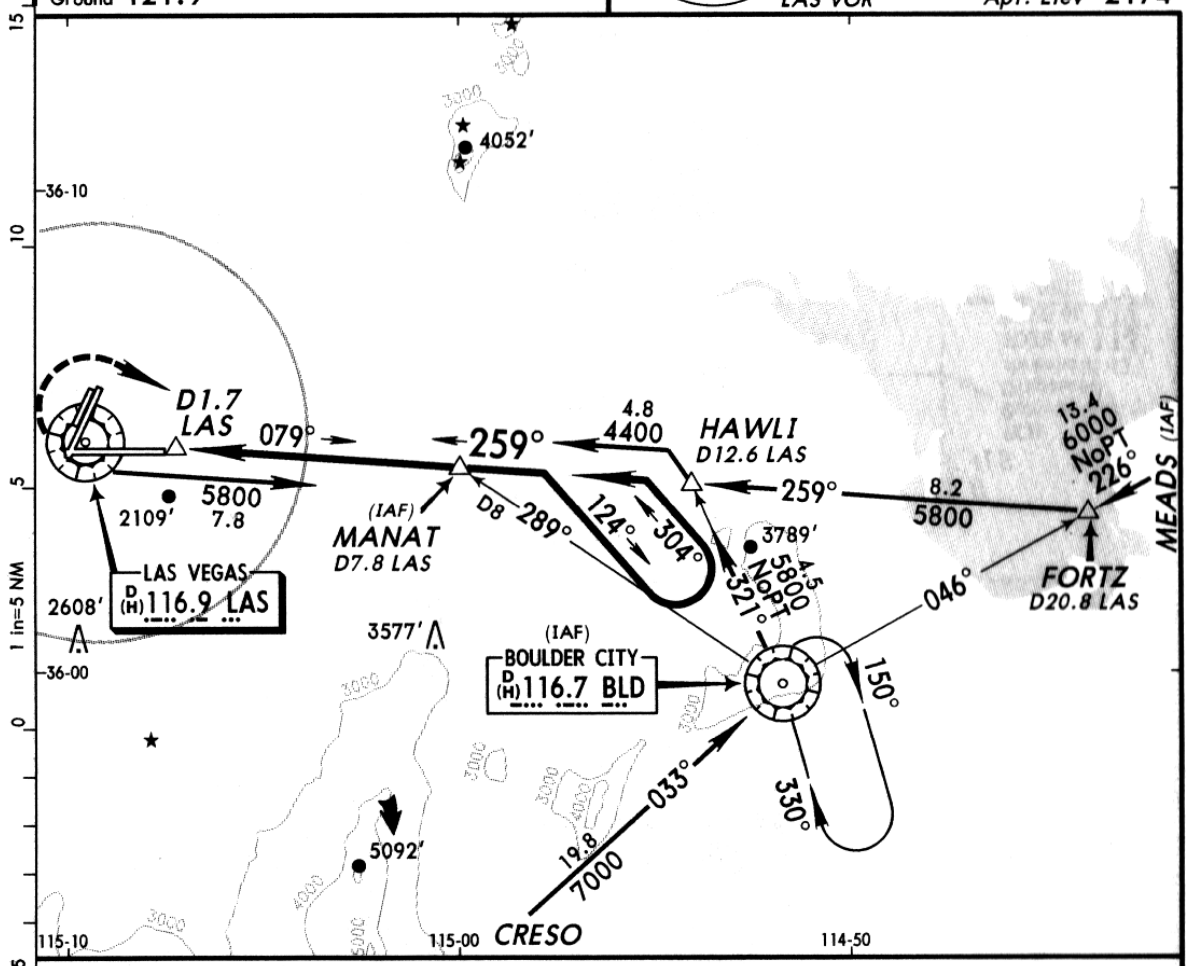
JEPPESEN FEB 2-90 (13-1)

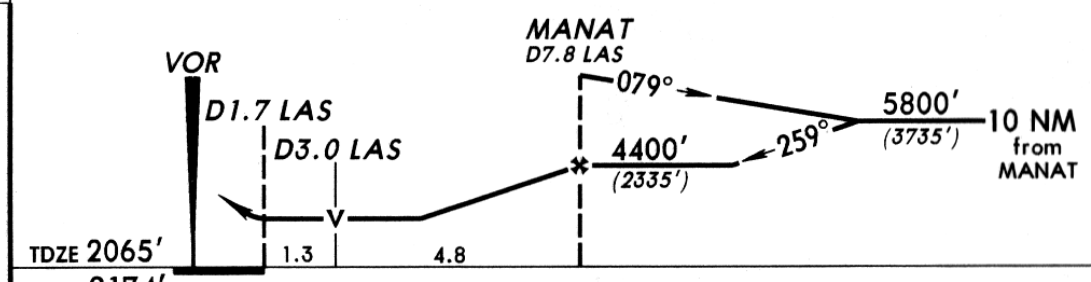
LAS VEGAS, NEV
Mc CARRAN INTL
VOR Rwy 25

VOR 116.9 LAS
Apt. Elev 2174'

ATIS Arrival 125.6
LAS VEGAS Approach (R) 127.15
LAS VEGAS Tower 119.9
Ground 121.9

MSA
LAS VOR
130° 10,500' 210°
13,000' 6500'
030° 8100' 300°





APT. 2174'

MISSED APPROACH: Climb to 2800' then climbing RIGHT turn to 6000' direct BLD VOR and hold.

	STRAIGHT-IN LANDING RWY 25 MDA(H) 2420' (355')			Max Kts	CIRCLE-TO-LAND MDA(H)
		RAIL out	ALS out		
A	1/2	3/4	1	90	2700'(526')-1
B				120	
C				140	2740'(566')-1½
D	1	1¼		165	2780'(606')-2

Gnd speed-Kts	70	90	100	120	140	160
MAP at D1.7 or MANAT to MAP 6.1	5:14	4:04	3:40	3:03	2:37	2:17

AMEND 11

CHANGES: Cat C circling MDA(H).

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JEPPESEN APR 21-89 (10-9)

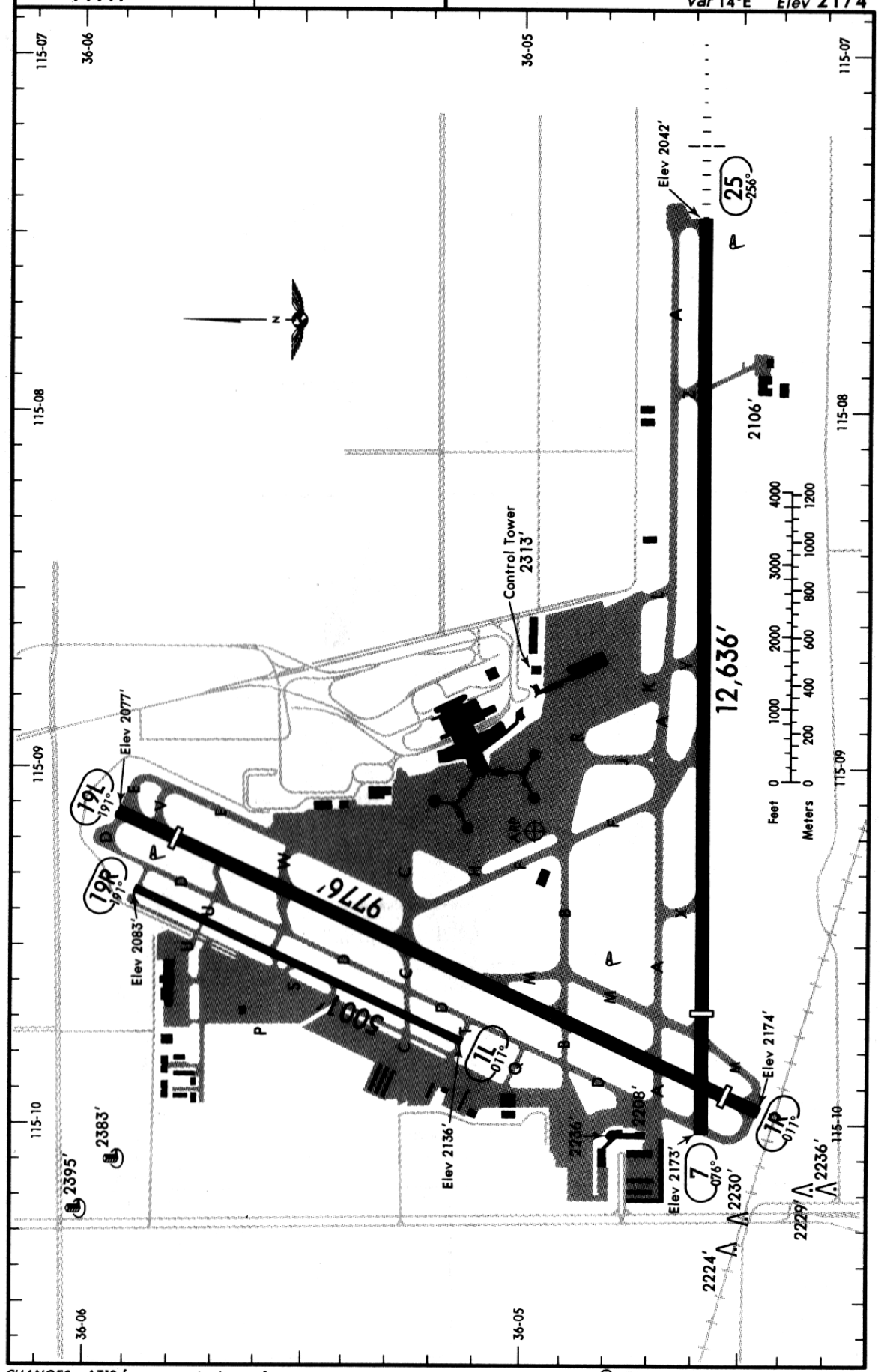
AIRPORT

KLAS
LAS VEGAS, NEV
Mc CARRAN INTL

LAS 116.9-On Airport N36 05.0 W115 09.2
Var 14°E Elev 2174'

ATIS Departure 116.9
LAS VEGAS Clearance 118.0
Ground 121.9
Tower 119.9

LAS VEGAS Departure (R)
North 133.95
South 125.9



CHANGES: ATIS frequency, taxiways & ramps.

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JEPPESEN MAY 11-90 (11-5)

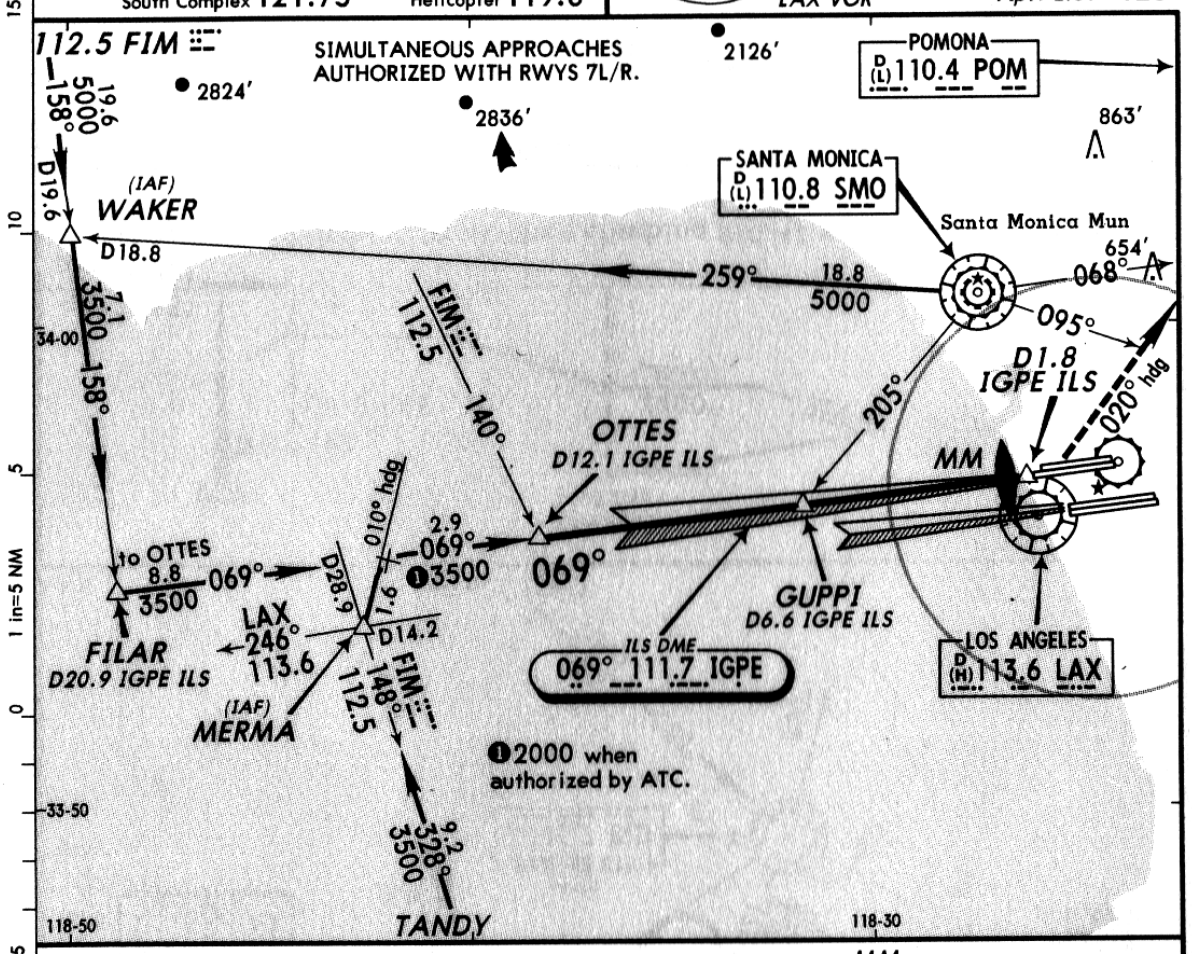
LOS ANGELES, CALIF
LOS ANGELES INTL
ILS Rwy 6R

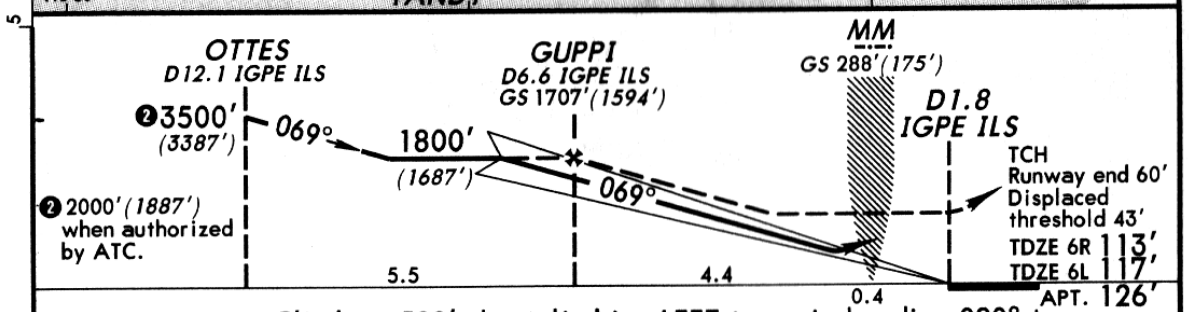
LOC 111.7 IGPE

Apt. Elev 126'

ATIS Arrival 133.8
LOS ANGELES Approach (R) (225°-044°) 124.5
(045°-089°) 128.5
(090°-224°) 124.9
LOS ANGELES Tower North Complex 133.9
South Complex 120.95
Ground North Complex 121.65
South Complex 121.75
Helicopter 119.8

MSA LAX VOR: 5100' (165°-050°), 7700' (050°-165°), 2900' (270°-270°)





MISSED APPROACH: Climb to 500' then climbing LEFT turn via heading 020° to cross SMO VOR R-095 at 2000' or below. Continue climb to 5000' outbound via SMO VOR R-068 or inbound on POM VOR R-248 to POM VOR.

	STRAIGHT-IN LANDING RWY 6R						SIDESTEP LANDING RWY 6L	
	ILS DA(H) 313'(200')			ILS DA(H) 363'(250')	LOC (GS out) MDA(H) 400'(287')		SIDESTEP MDA(H) 440'(323')	
	FULL	TDZ or CL out	RAIL or ALS out	MM out		RAIL out	ALS out	RAIL or ALS out
A, B, C	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	RVR 50 or 1
C								RVR 50 or 1 — 1½
D				RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1		1½ — 2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	646	754	862
MAP at D1.8 IGPE ILS or GUPPI to MAP	4.8	4:07	3:12	2:53	2:24	2:03	1:48

AMEND 13

CHANGES: Sidestep landing rwy 6L MDA(H).

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JEPPESEN MAY 11-90 (11-7)

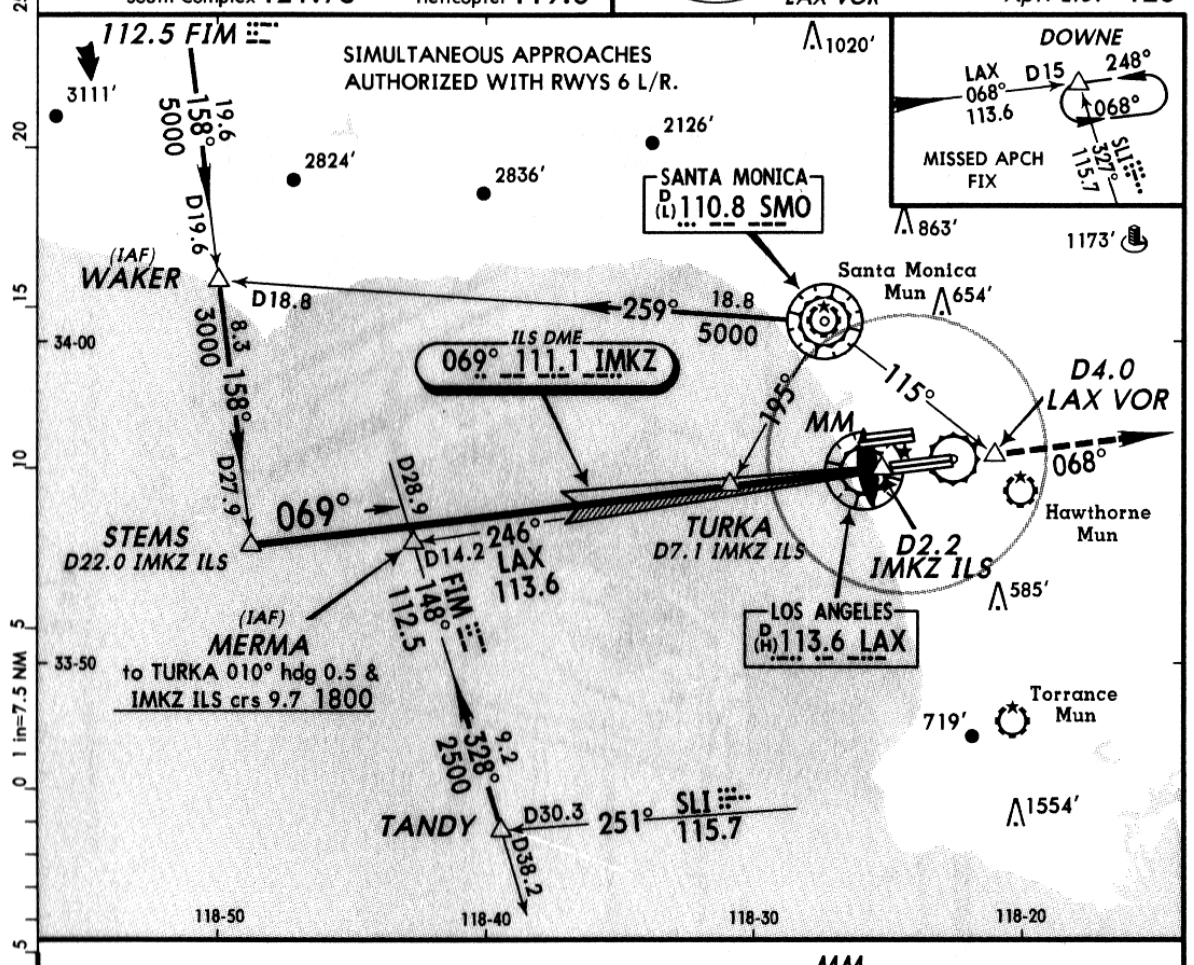
LOS ANGELES, CALIF
LOS ANGELES INTL
ILS Rwy 7R

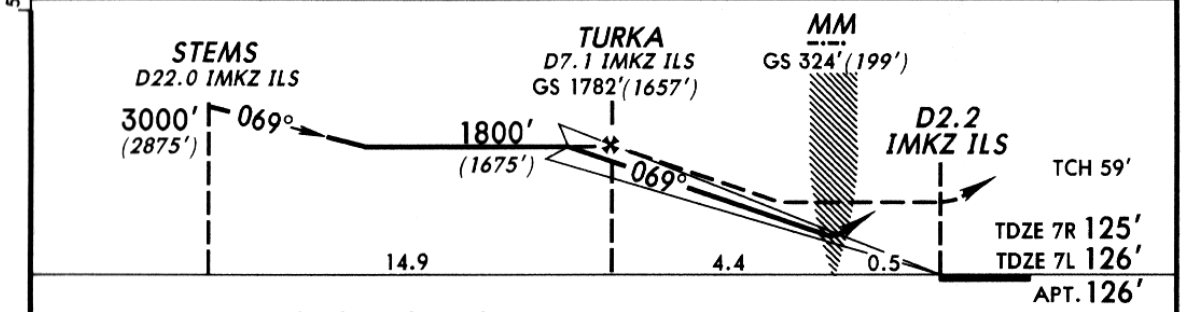
LOC 111.1 IMKZ

Apt. Elev 126'

ATIS Arrival 133.8
LOS ANGELES Approach (R) (225°-044°) 124.5
(045°-089°) 128.5
(090°-224°) 124.9
LOS ANGELES Tower North Complex 133.9
South Complex 120.95
Ground North Complex 121.65
South Complex 121.75
Helicopter 119.8

MSA LAX VOR: 5100' (165°-050°), 7700' (050°-165°), 2900' (270°-270°)





MISSED APPROACH: Climb outbound via LAX VOR R-068, cross D4.0 LAX or SMO VOR R-115 at or below 2000', continue climb to 3500' to DOWNE INT and hold.

	STRAIGHT-IN LANDING RWY 7R						SIDESTEP LANDING RWY 7L	
	ILS DA(H) 325'(200')			ILS DA(H) 375'(250')	LOC (GS out) MDA(H) 460'(335')		SIDESTEP MDA(H) 460'(334')	
	FULL	RAIL or ALS out		MM out		RAIL out	ALS out	RAIL or ALS out
A, B, C	RVR 24 or ½	RVR 40 or ¾		RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	RVR 50 or 1
C								RVR 50 or 1 — 1½
D				RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1		1½ — 2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	754	862
MAP at D2.2 IMKZ ILS or TURKA to MAP	4.9	4:12	3:16	2:56	2:27	2:06	1:50

AMEND 1

CHANGES: See other side.

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JEPPESEN APR 27-90 (11-1A)

LOS ANGELES, CALIF
LOS ANGELES INTL
ILS Rwy 24R CAT II & III

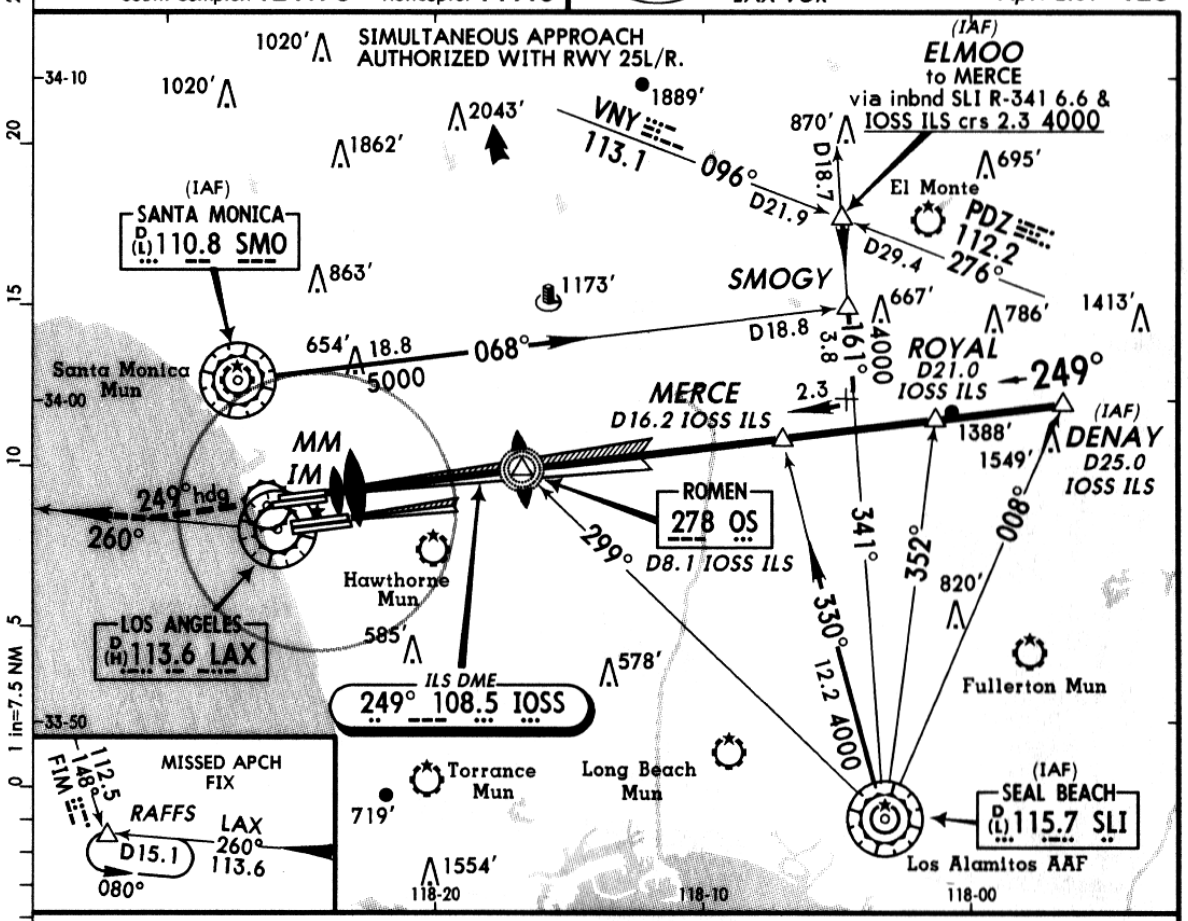
Special Aircrew & Acft Certification Required

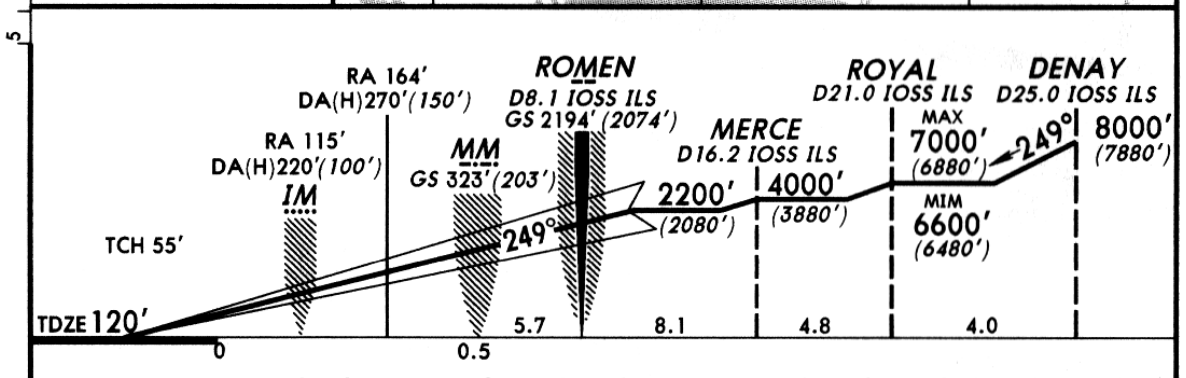
LOC 108.5 IOSS

Apt. Elev 126′

ATIS Arrival 133.8
LOS ANGELES Approach (R) (225°-044°) 124.5
(045°-089°) 128.5
(090°-224°) 124.9
LOS ANGELES Tower North Complex 133.9
South Complex 120.95
Ground North Complex 121.65
South Complex 121.75 Helicopter 119.8

MSA LAX VOR
5100′ 7700′ 2900′ 165° 050° 270°


SIMULTANEOUS APPROACH AUTHORIZED WITH RWY 25L/R.
(IAF) ELMOO to MERCE via inbnd SLI R-341 6.6 & IOSS ILS crs 2.3 4000
(IAF) SANTA MONICA D (L) 110.8 SMO
VNY 113.1
PDZ 112.2
SMOGY
ROYAL D21.0 IOSS ILS
MERCE D16.2 IOSS ILS
(IAF) DENAY D25.0 IOSS ILS
ROMEN 278 OS D8.1 IOSS ILS
MM IM
LOS ANGELES D (H) 113.6 LAX
ILS DME 249° 108.5 IOSS
Santa Monica Mun
Hawthorne Mun
Torrance Mun
Long Beach Mun
Fullerton Mun
El Monte
Los Alamitos AAF
(IAF) SEAL BEACH D (L) 115.7 SLI
MISSED APCH FIX RAFFS D15.1 LAX 260° 113.6 080°
249° hdg 260°
068° 096° 249° 299° 330° 341° 352° 008°
1020′ 1889′ 2043′ 1862′ 870′ 695′ 863′ 1173′ 667′ 786′ 1413′ 654′ 585′ 578′ 820′ 719′ 1554′ 1549′ 1388′
D18.7 D21.9 D29.4 D18.8 3.8 2.3 12.2 4000
5000 4000
34-10 34-00 33-50 118-20 118-10 118-00



MISSED APPROACH: Climb to 2000′ via heading 249° and outbound LAX VOR R-260 to RAFFS INT/D15.1 LAX VOR and hold.

STRAIGHT-IN LANDING RWY 24R

CAT IIIA ILS	CAT II ILS	
	RA 115′ DA(H) 220′ (100′)	RA 164′ DA(H) 270′(150′)
RVR 7	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	379	487	541	649	757	866

AMEND 19

CHANGES: MSA.

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JEPPESEN APR 27-90 (11-2A)

LOS ANGELES, CALIF
LOS ANGELES INTL
ILS Rwy 25L CAT II

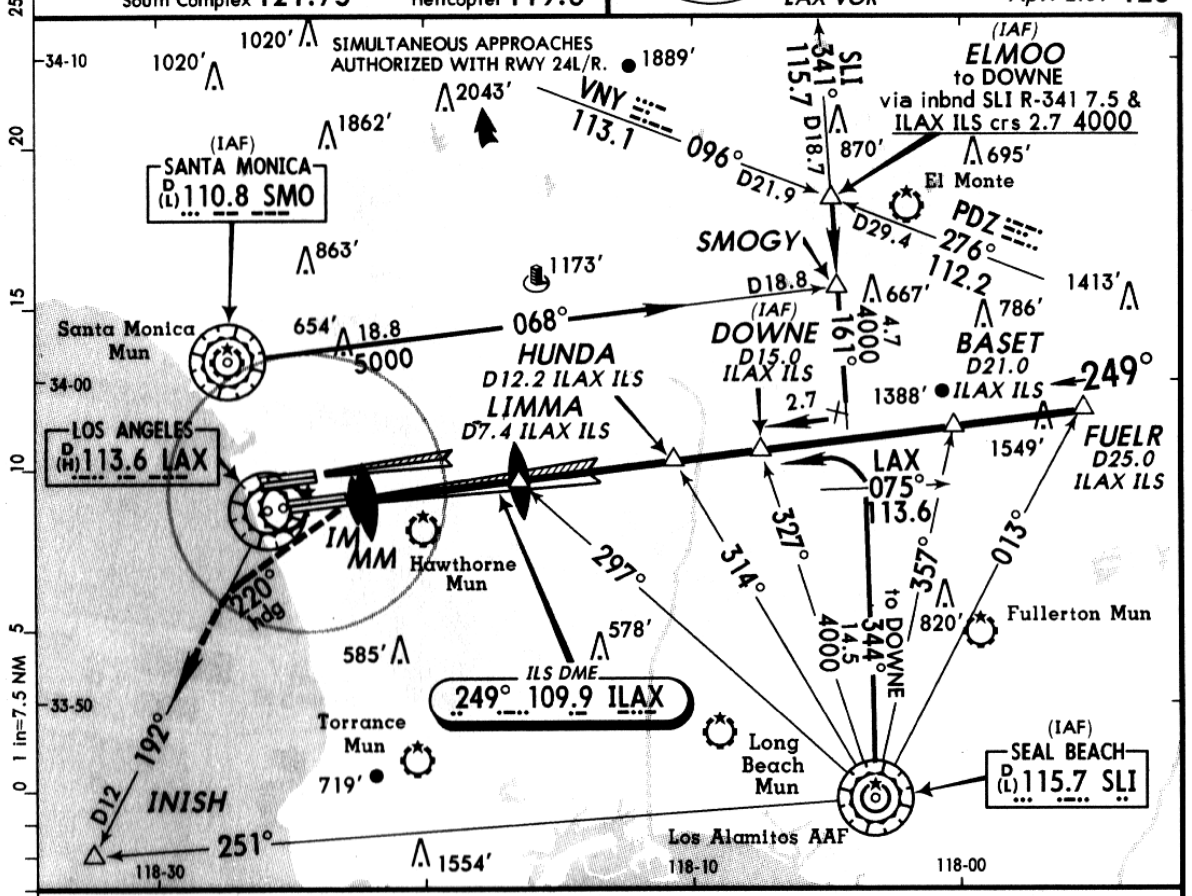
Special Aircrew & Acft Certification Required

LOC 109.9 ILAX

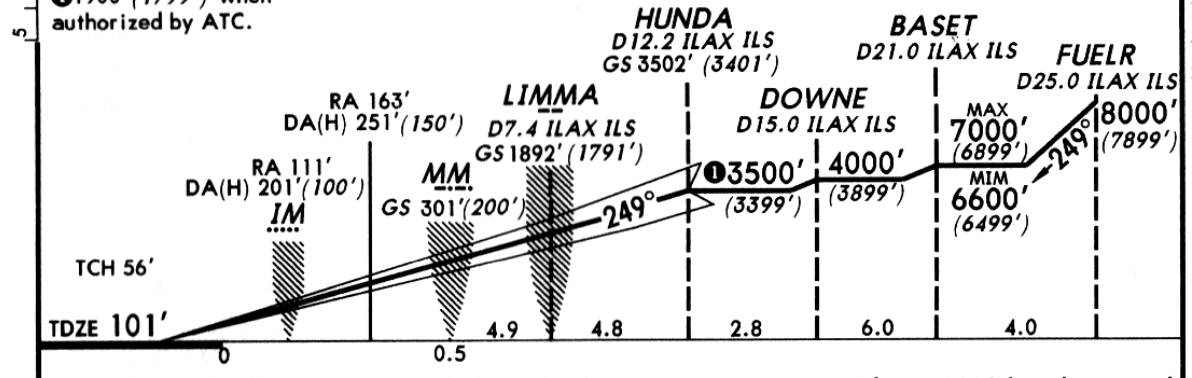
Apt. Elev 126′

ATIS Arrival 133.8
LOS ANGELES Approach (R) (225°-044°) 124.5
(045°-089°) 128.5
(090°-224°) 124.9
LOS ANGELES Tower North Complex 133.9
South Complex 120.95
Ground North Complex 121.65
South Complex 121.75 Helicopter 119.8

MSA LAX VOR
5100′ 7700′ 2900′ 165° 050° 270°


SIMULTANEOUS APPROACHES AUTHORIZED WITH RWY 24L/R.
(IAF) ELMOO to DOWNE via inbnd SLI R-341 7.5 & ILAX ILS crs 2.7 4000
(IAF) SANTA MONICA D (L) 110.8 SMO
VNY 113.1
SLI 115.7
PDZ 112.2
SMOGY
HUNDA D12.2 ILAX ILS
LIMMA D7.4 ILAX ILS
(IAF) DOWNE D15.0 ILAX ILS
BASET D21.0 ILAX ILS
FUELR D25.0 ILAX ILS
LOS ANGELES D (H) 113.6 LAX
ILS DME 249° 109.9 ILAX
IM MM
Santa Monica Mun
Hawthorne Mun
Torrance Mun
Long Beach Mun
Fullerton Mun
El Monte
Los Alamitos AAF
(IAF) SEAL BEACH D (L) 115.7 SLI
INISH D12
068° 096° 161° 220° 249° 251° 297° 314° 327° 344° 357° 013°
1020′ 1889′ 2043′ 1862′ 870′ 695′ 863′ 1173′ 667′ 786′ 1413′ 654′ 585′ 578′ 820′ 719′ 1554′ 1549′ 1388′
D18.7 D21.9 D29.4 D18.8 4.7 2.7 14.5 4000
5000 4000
34-10 34-00 33-50 118-30 118-10 118-00

❶1900′ (1799′) when authorized by ATC.



MISSED APPROACH: Climb to 500′ then climbing LEFT turn to 2000′ via 220° heading until intercepting outbound LAX VOR R-192, then climb to 2500′ to INISH INT/D12.0 LAX.

STRAIGHT-IN LANDING RWY 25L

CAT II ILS	
RA 111′ DA(H) 201′ (100′)	RA 163′ DA(H) 251′(150′)
RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864

AMEND 1

CHANGES: MSA.

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ATIS Departure 135.65
LOS ANGELES Clearance 121.4
Ground North Complex 121.65 South Complex 121.75
Tower North Complex 133.9 South Complex 120.95
Helicopter 119.8

LOS ANGELES Departure (R)
249°-044° 125.2
045°-248° 124.3
(Limited) VOT 113.9

118-26 118-23

STANDARD TAXI ROUTES

CAUTION: Impaired wing clearance may exist on taxiway J between 30-K and 19-K when taxilane K occupied. 165′ centerline to centerline. Turbulence may be deflected upward from blast fence east of rwy 25R.

Twys 2L, 8L, 11F, 20G, 30L, 32L, 36L, 42L, T33 and 32S will not accommodate a B747-200, 300 or 400 aircraft.

There is insufficient clearance between vehicles on the adjacent service roads and B747-400 aircraft on twy K27 and on twy F between 42G and F57.

NORTH ROUTE: For taxi to the north complex;
Departure: "Runway 24L taxi via North route"
Arrival: "Taxi via North route to the gate"
This instruction means: Taxi via Kilo Inner towards taxiway 48, taxi northbound on taxiway 48, at the 50 yard line contact ground control on frequency 121.65, hold short of taxiway Tango Inner. When advised by the north ground control, the North route continues on taxiway Uniform Outer to runway 24L or the gate, whichever applies.

SOUTH ROUTE: For taxi to the south complex;
Departure: "Runway 25R taxi via South route"
Arrival: "Taxi via South route to the gate"
This instruction means: If the aircraft is west of taxiway 49, taxi eastbound on taxiway Uniform Outer and turn right on taxiway 49, if the aircraft is east of taxiway 49, taxi westbound on taxiway Tango Inner and turn left on taxiway 49, at the 50 yard line contact ground control on frequency 121.75, hold short of taxiway Kilo Inner. When advised by south ground control, the South route continues on taxiway Juliet Outer to runway 25R or the gate, whichever applies.

Tower may clear aircraft for take-off rwy 24L from taxiway 36-U; 9572′ available from taxiway centerline.

Taxiway Tango between taxilanes 32 & 35 (north of Terminal One) is restricted to B-767 or smaller aircraft.

Tower may clear aircraft for take-off rwy 25R from taxiway 8-J; 11045′ available from taxiway centerline.

Tower may clear aircraft for take-off rwy 25R from taxiway 26-J; 7834′ available from taxiway centerline.

33-57 33-56

Elev 112′ 6L 069° 8925′ Elev 111′ 24R 249° Elev 117′
10,285′
Elev 108′ 6R 069° 175′ REMOTE GATES
WEST PADS
11,096′ 7L 069° Elev 119′ Elev 118′ 7R 069°
12,091′ 24L 249° 25R 249° Elev 92′ Blast Fence 8′ 25L 249° Elev 95′
UNIFORM OUTER
TANGO INNER
KILO INNER
JULIET OUTER
ATC NON VIS AREA
50 YD LINE
BRADLEY INTL TERMINAL
Blast Fence
Control Tower
AIR FREIGHT TERMINALS
IMPERIAL TERMINAL
FEDERAL EXPRESS
GENERAL AVIATION
IMPERIAL CARGO COMPLEX
USA NWA USCG TWA FDX COA AAL MERCURY ARG PAA KAL JAL ACA DLH FAA CAL AFR EAL DAL UAL AMX, BAW, NWA, VRG, DAL
T-33
196′ 198′ 247′ 238′ 305′ 294′ 310′ 192′ 217′ 302′ 293′ 276′

N

Feet 0 500 1000 1500 2000 2500 3000
Meters 0 200 400 600 800 1000

118-26 118-25 118-24 118-23

CHANGES: Standard taxi route notes.

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JEPPESEN MAY 18-90 (11-2)

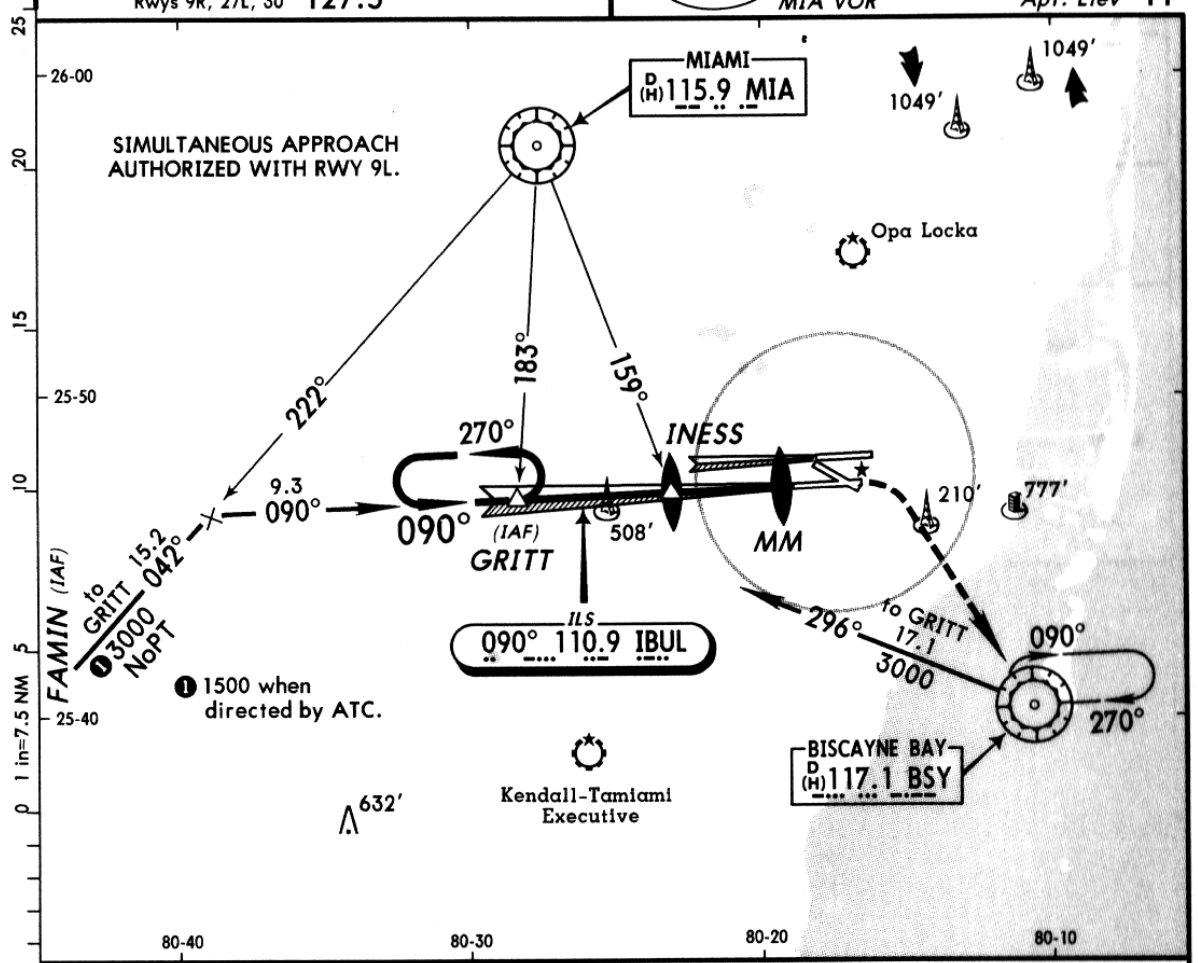
MIAMI, FLA
MIAMI INTL
ILS Rwy 9R

LOC 110.9 IBUL

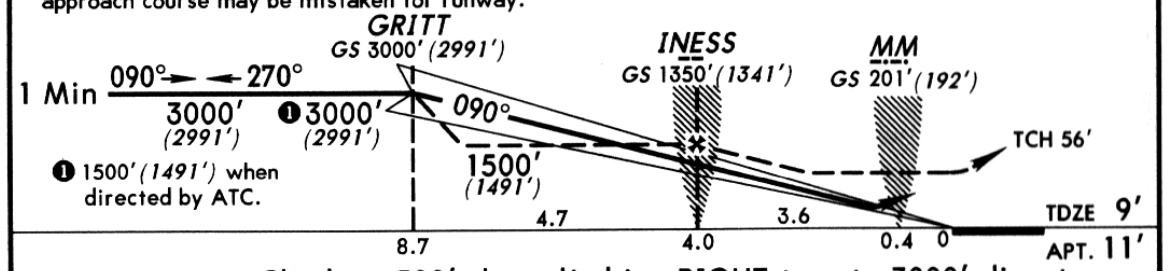
ATIS Arrival 117.1
MIAMI Approach (R) 126.85
MIAMI Tower 270°-089° 118.3
090°-269° 123.9
Ground Rwys 9L, 12, 27R 121.8
Rwys 9R, 27L, 30 127.5

MSA MIA VOR
1500′ 2900′ 040° 180°

Apt. Elev 11′



CAUTION: Lights on highway ¼ NM south of final approach course may be mistaken for runway.



MISSED APPROACH: Climb to 500′ then climbing RIGHT turn to 3000′ direct BSY VOR and hold.

STRAIGHT-IN LANDING RWY 9R	ILS		LOC (GS out)				CIRCLE-TO-LAND
	DA(H) 209′ (200′)		DA(H) 259′ (250′)	MDA(H) 380′ (371′)			
	FULL	RAIL or ALS out	MM out	MM out	RAIL out	ALS out	
A	½	¾	½	½	¾	1	NA
B							
C							
D			¾	¾	1	1¼	

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	376	484	537	645	752	860
INESS to MAP	4.0	3:26	2:40	2:24	2:00	1:43	1:30

AMEND 6

CHANGES: See other side.

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JEPPESEN OCT 16-87 (11-5) Eff Oct 22

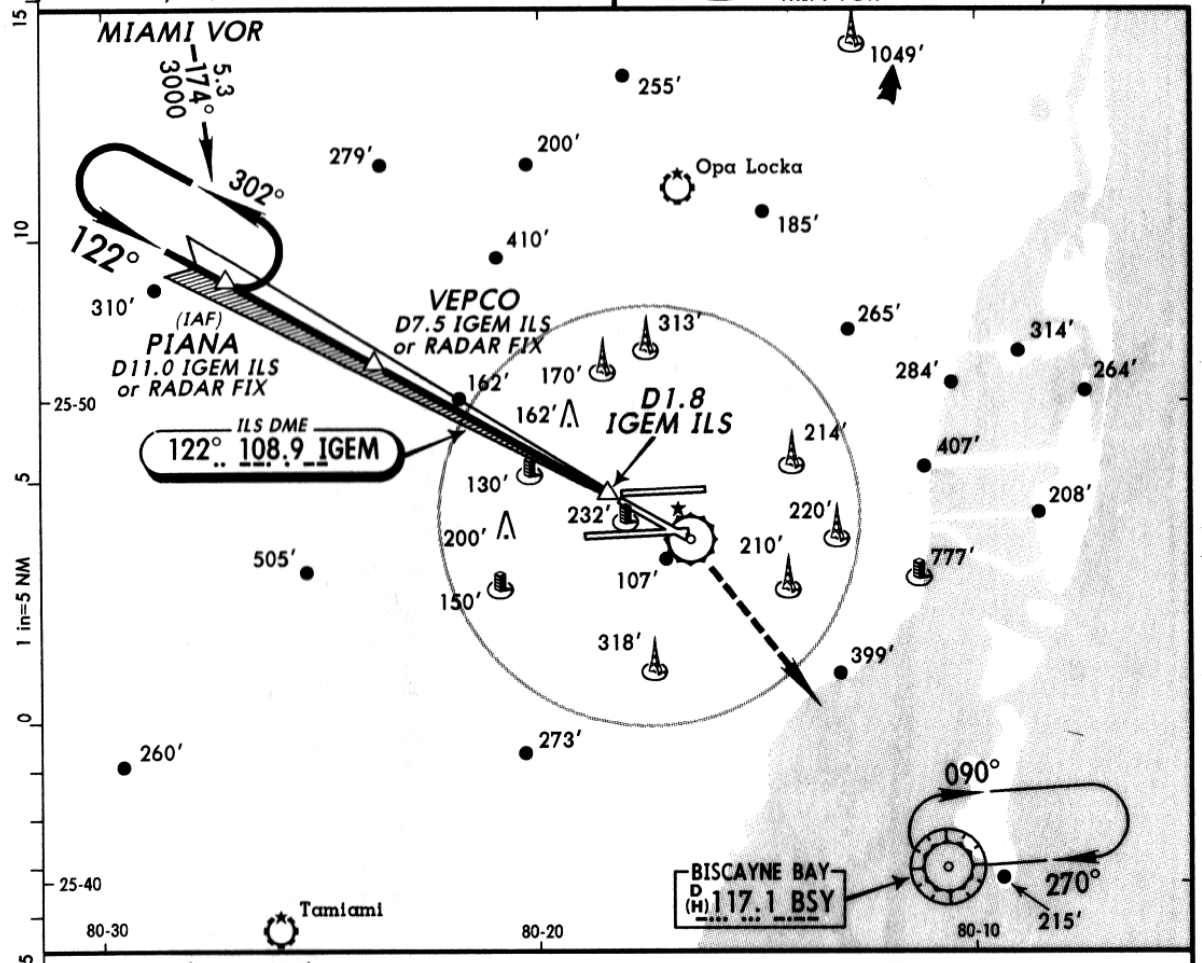
MIAMI, FLA
MIAMI INTL
ILS Rwy 12

LOC 108.9 IGEM

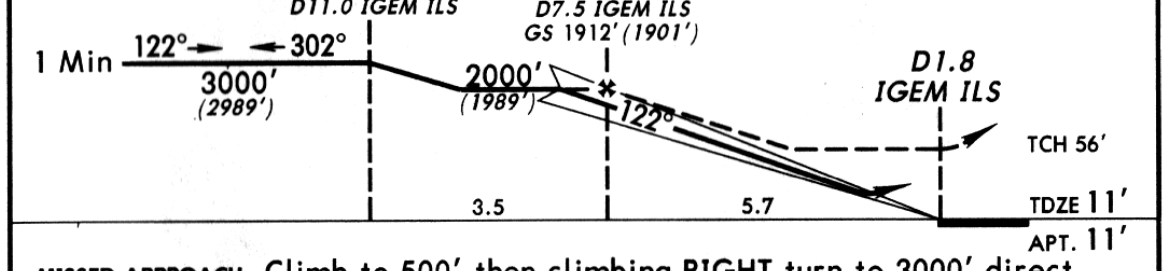
ATIS Arrival 117.1
MIAMI Approach (R) 126.85
MIAMI Tower 270°-089° 118.3
090°-269° 123.9
Ground Rwys 9L, 12, 27R 121.8
Rwys 9R, 27L, 30 127.5

MSA MIA VOR
1500′ 2900′ 040° 180°

Apt. Elev 11′



DME or Radar required.



MISSED APPROACH: Climb to 500′ then climbing RIGHT turn to 3000′ direct BSY VOR and hold.

STRAIGHT-IN LANDING RWY 12	ILS	LOC (GS out)	CIRCLE-TO-LAND
	DH 261′ (250′)	MDA 420′ (409′)	
A	RVR 40 or ¾	RVR 50 or 1	NA
B			
C		RVR 60 or 1¼	
D			

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	757	865
MAP at D1.8 IGEM or VEPCO to MAP	5.7	4:53	3:48	3:25	2:51	2:27	2:08

AMEND 1

CHANGES: Procedure.

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JEPPESEN MAY 18-90 (11-3)

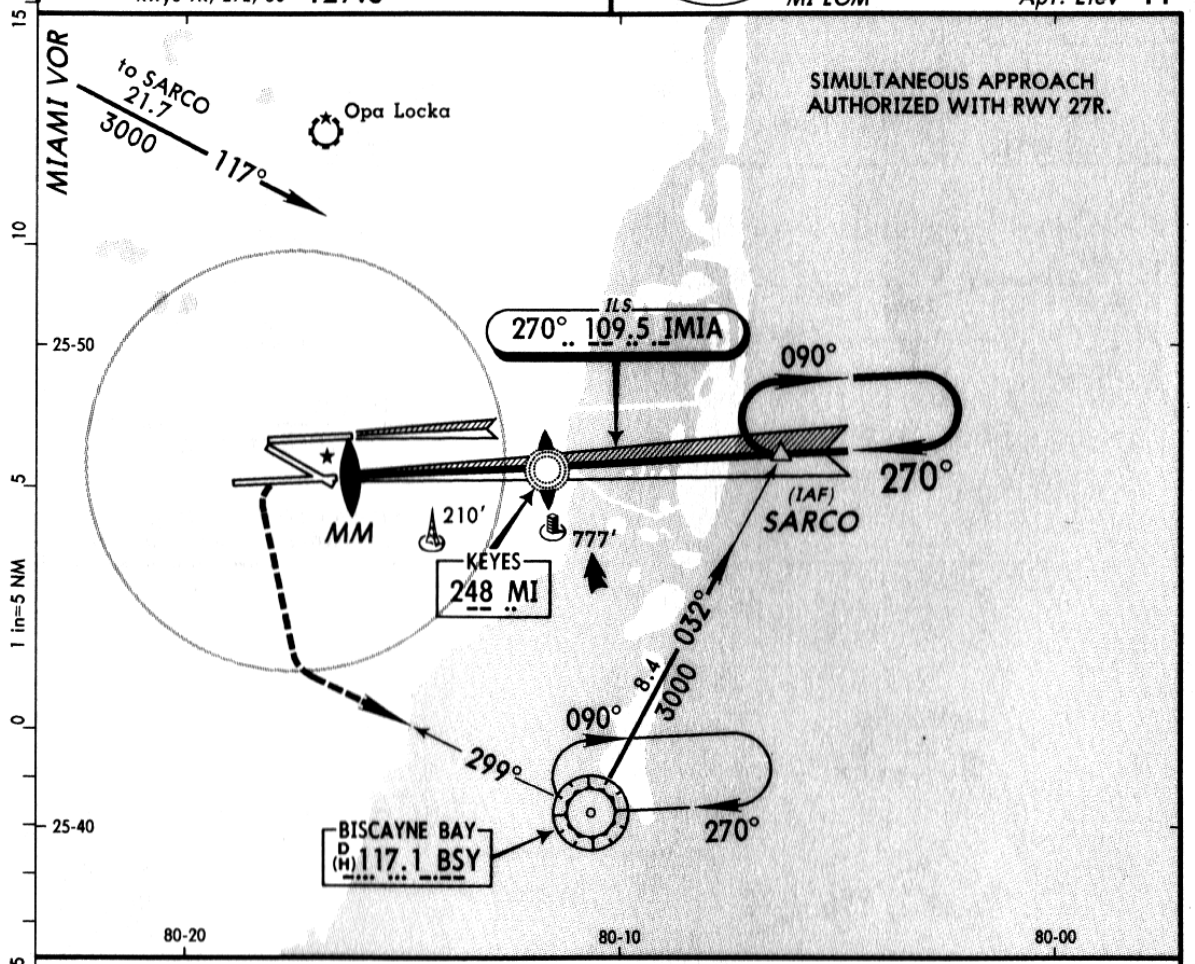
MIAMI, FLA
MIAMI INTL
ILS Rwy 27L

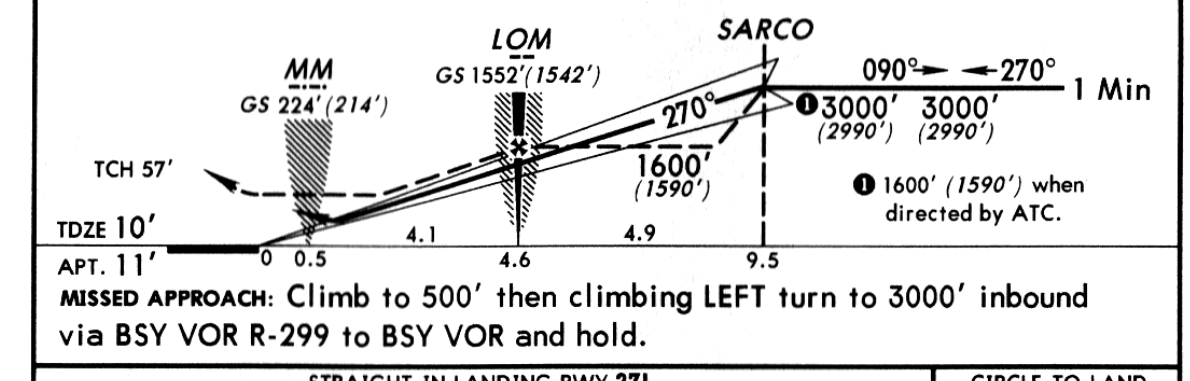
LOC 109.5 IMIA

Apt. Elev 11′

ATIS Arrival 117.1
MIAMI Approach (R) 126.85
MIAMI Tower 270°-089° 118.3
090°-269° 123.9
Ground Rwys 9L, 12, 27R 121.8
Rwys 9R, 27L, 30 127.5

MSA
MI LOM
225° 1700′ 315° 2900′





MISSED APPROACH: Climb to 500′ then climbing LEFT turn to 3000′ inbound via BSY VOR R-299 to BSY VOR and hold.

STRAIGHT-IN LANDING RWY 27L							CIRCLE-TO-LAND
ILS				LOC (GS out)			
DA(H) 260′ (250′)				MDA(H) 560′ (550′)			
FULL	RAIL or ALS out		MM out				
A	RVR 50 or 1			RVR 50 or 1	A		NA
B					B		
C				1½	C		
D				1¾	D		

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	538	646	754	861
LOM to MAP 4.6	3:57	3:04	2:46	2:18	1:58	1:44

AMEND 21

CHANGES: LOC (GS out) minimums.

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JEPPESEN MAY 18-90 (10-9)

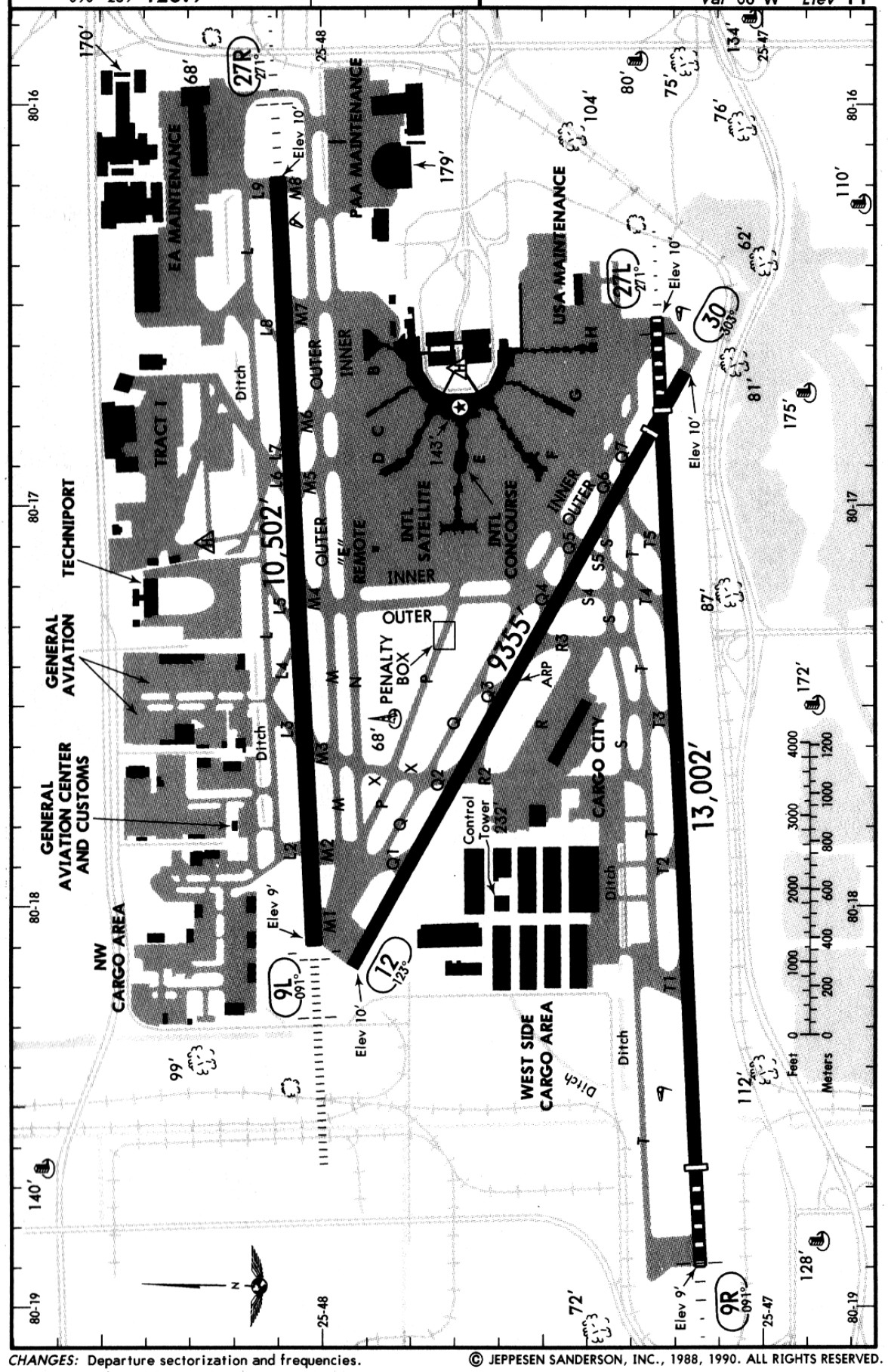
AIRPORT

KMIA
MIAMI, FLA
MIAMI INTL

323.9°/9.5 From BSY 117.1 N25 47.6 W080 17.4
Var 03°W Elev 11′

ATIS Departure 119.15
MIAMI Clearance 135.35
MIAMI Ground Rwys 9L,12,27R 121.8
Rwys 9R,27L,30 127.5
Tower 270°-089° 118.3
090°-269° 123.9

MIAMI Departure (R)
270°-089° 119.45
090°-269° 125.5



CHANGES: Departure sectorization and frequencies.

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JEPPESEN MAR 9-90 (11-1A)

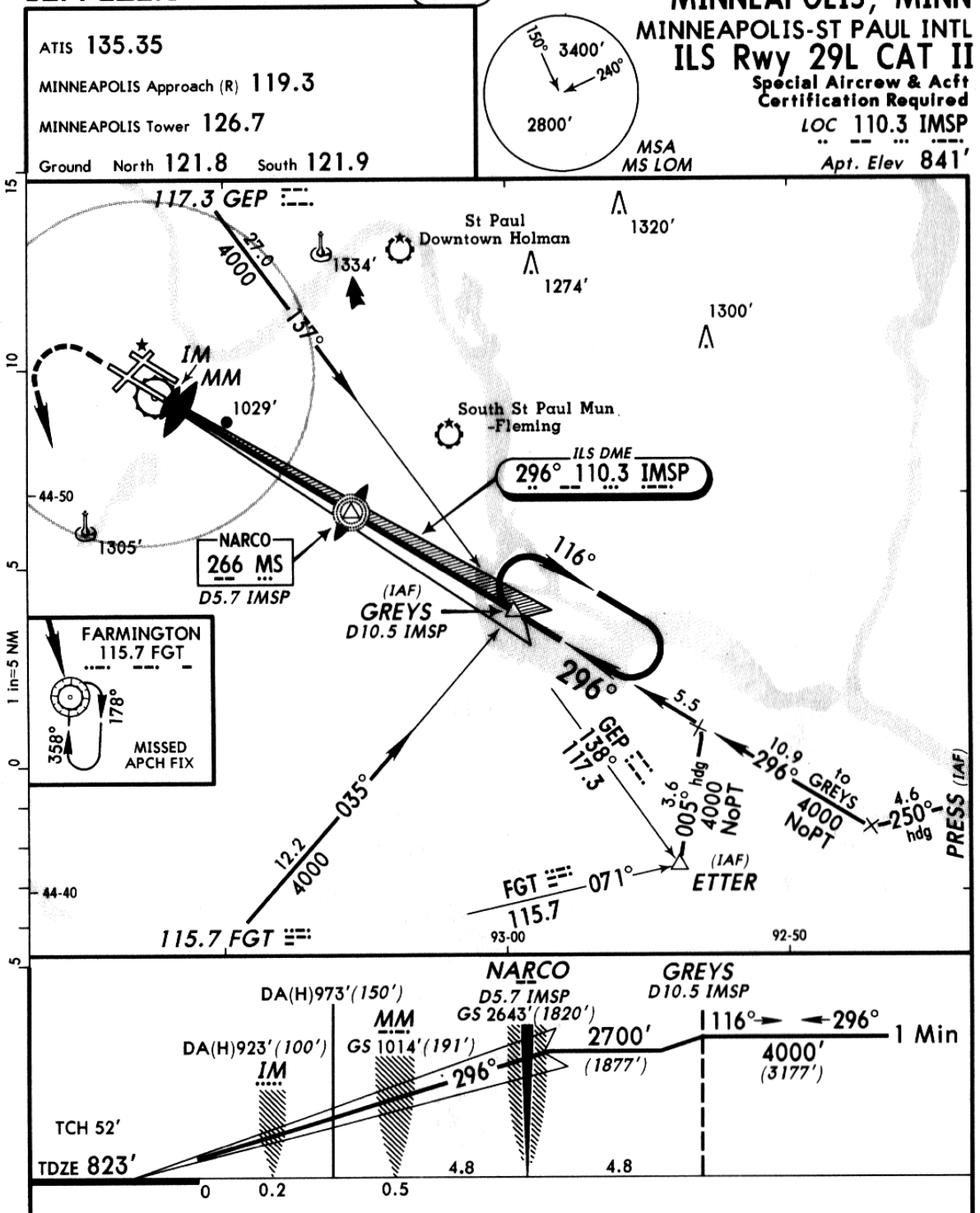
MINNEAPOLIS, MINN
MINNEAPOLIS-ST PAUL INTL
ILS Rwy 29L CAT II

Special Aircrew & Acft Certification Required

LOC 110.3 IMSP

Apt. Elev 841′

ATIS 135.35
MINNEAPOLIS Approach (R) 119.3
MINNEAPOLIS Tower 126.7
Ground North 121.8 South 121.9



MISSED APPROACH: Climb to 1500′, then climbing LEFT turn to 4000′, direct FGT VOR and hold.

STRAIGHT-IN LANDING RWY 29L
CAT II ILS
RA NOT AUTH

DA(H) 923′ (100′)	DA(H) 973′ (150′)
RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864

AMEND 39

CHANGES: Ground frequencies.

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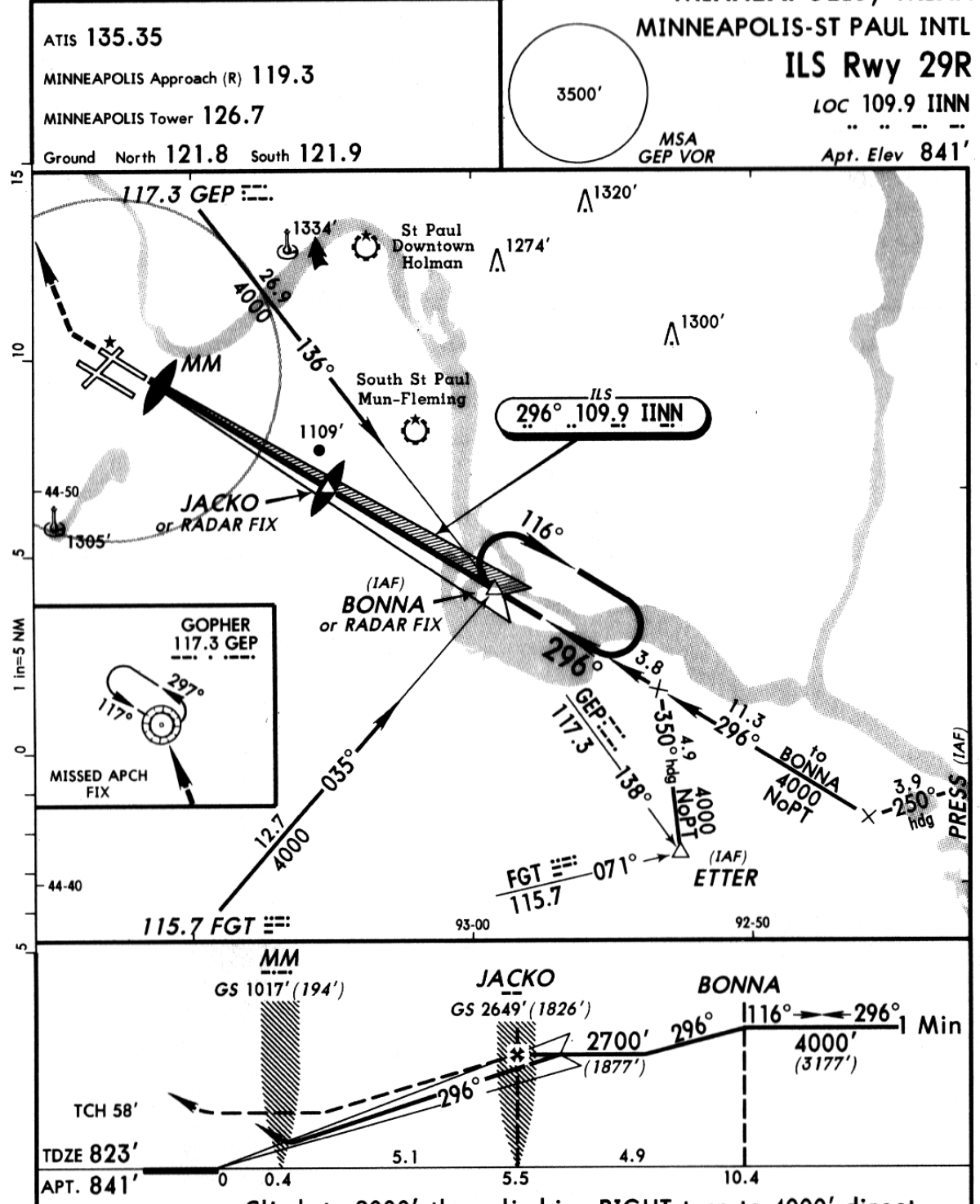
JEPPESEN MAR 9-90 (11-5)

MINNEAPOLIS, MINN
MINNEAPOLIS-ST PAUL INTL
ILS Rwy 29R

LOC 109.9 IINN

Apt. Elev 841′

ATIS 135.35
MINNEAPOLIS Approach (R) 119.3
MINNEAPOLIS Tower 126.7
Ground North 121.8 South 121.9



MISSED APPROACH: Climb to 2000′ then climbing RIGHT turn to 4000′ direct GEP VOR and hold.

STRAIGHT-IN LANDING RWY 29R

	ILS DA(H) 1023′ (200′)	ILS DA(H) 1073′ (250′) MM out	LOC (GS out) MDA(H) 1360′ (537′)	CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
A	3/4	3/4	1	90	1360′(519′)-1
B				120	
C			1½	140	1360′(519′)-1½
D			1¾	165	1460′(619′)-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
JACKO to MAP	5.5	4:43	3:40	3:18	2:45	2:21	2:04

AMEND 5

CHANGES: Ground frequencies.

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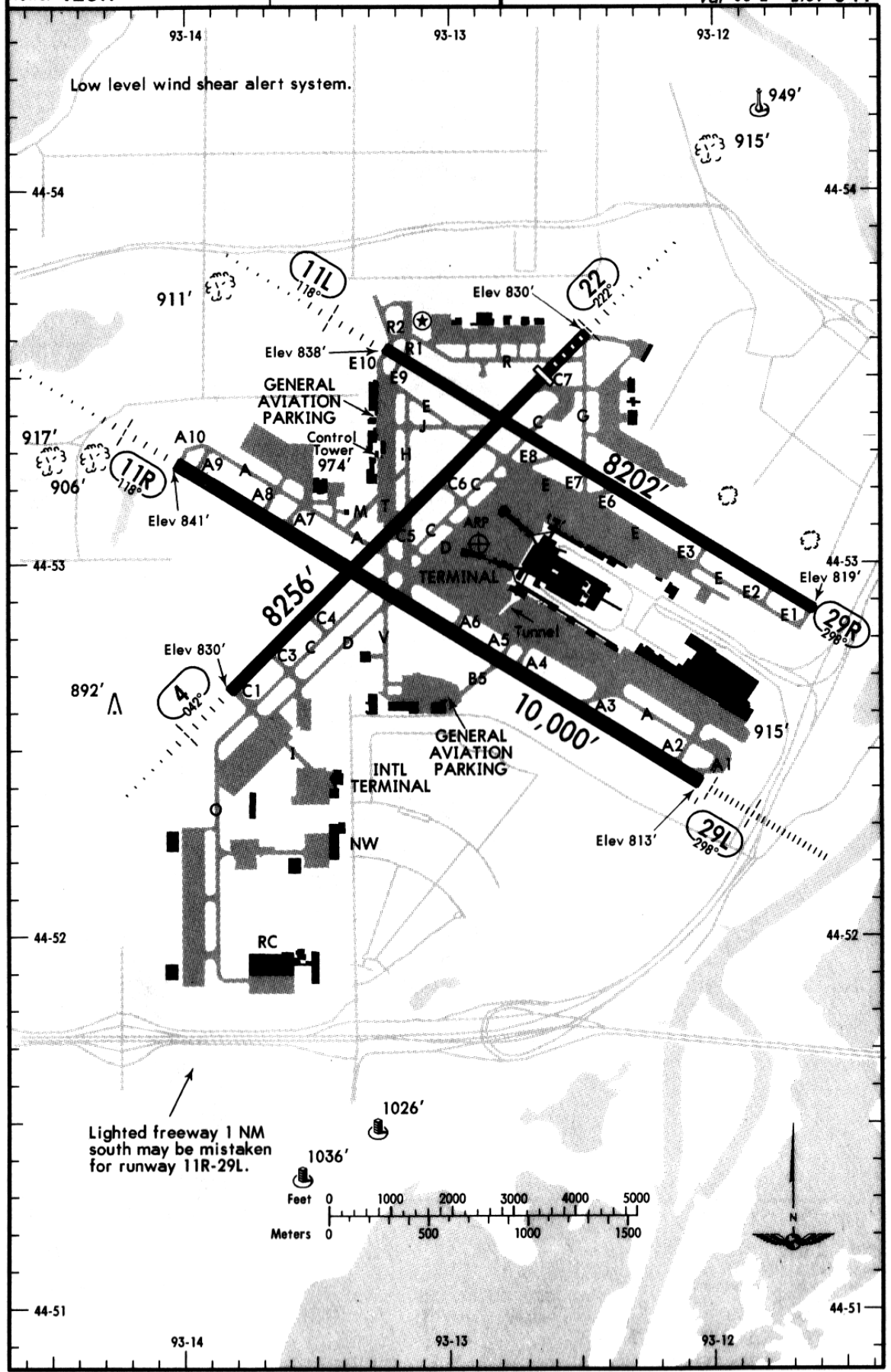
JEPPESEN MAR 9-90 (10-9) KMSP AIRPORT

MINNEAPOLIS, MINN
MINNEAPOLIS-ST PAUL INTL

ATIS 135.35
MINNEAPOLIS Clearance (Cpt) 133.2
Ground North 121.8 South 121.9
Tower 126.7

MINNEAPOLIS Departure (R)
N or E of Dep Rwy 120.0
S or W of Dep Rwy 124.7
VOT 111.0

MSP 115.3-On Airport N44 53.1 W093 12.9
Var 03°E Elev 841'



CHANGES: Communications.

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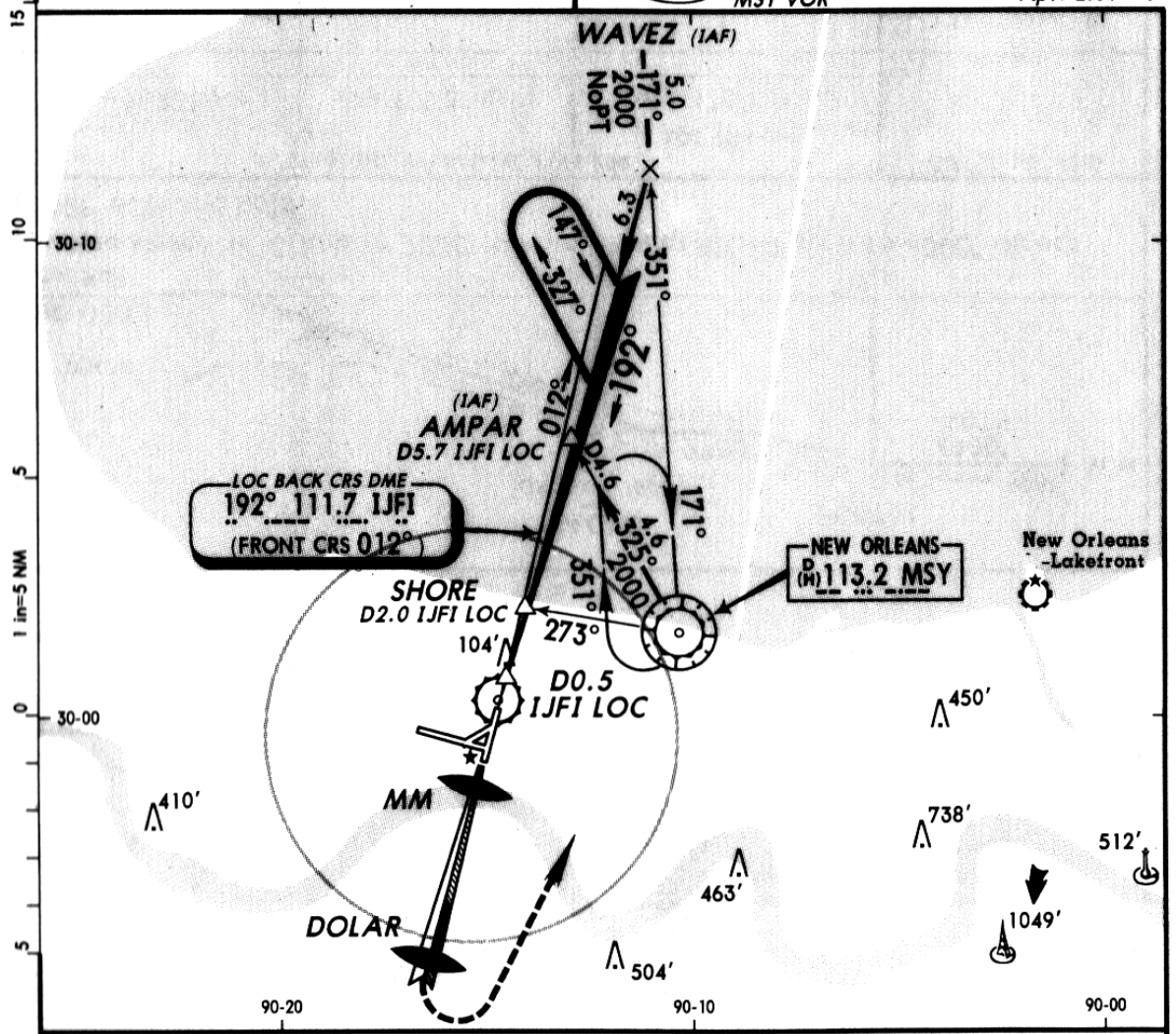
JEPPESEN MAR 2-90 (11-4) Eff Mar 8

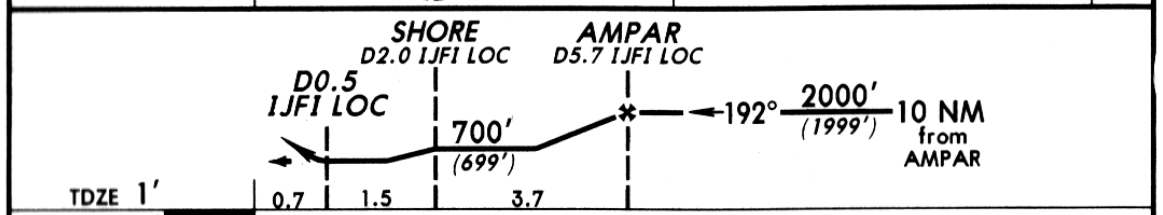
NEW ORLEANS, LA
NEW ORLEANS INTL
LOC (BACK CRS) Rwy 19

ATIS Arrival 127.55
NEW ORLEANS Approach (R) 125.5
MOISANT Tower 119.5
Ground 121.9

2100' MSA MSY VOR

LOC 111.7 IJFI
Apt. Elev 4'





MISSED APPROACH: Climb to 2000' then LEFT turn direct MSY VOR and hold.

	STRAIGHT-IN LANDING RWY 19				CIRCLE-TO-LAND		
	MDA(H) 360' (359') With Shore		MDA(H) 700' (699') Without Shore			With Shore	Without Shore
		ALS out		ALS out	Max Kts.	MDA(H)	MDA(H)
A	RVR 40 or ¾	RVR 50 or 1	RVR 40 or ¾	RVR 50 or 1	90	520' (516') - 1	700' (696') - 1
B					120		
C			2		140	520' (516') - 1½	700' (696') - 2
D	RVR 60 or 1¼		2¼		165	660' (656') - 2	700' (696') - 2¼

Gnd speed-Kts	70	90	100	120	140	160
MAP at D0.5 IJFI LOC or AMPAR to MAP 5.2	4:27	3:28	3:07	2:36	2:14	1:57

AMEND 11

CHANGES: Procedure.

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JEPPESEN APR 6-90 (11-1)

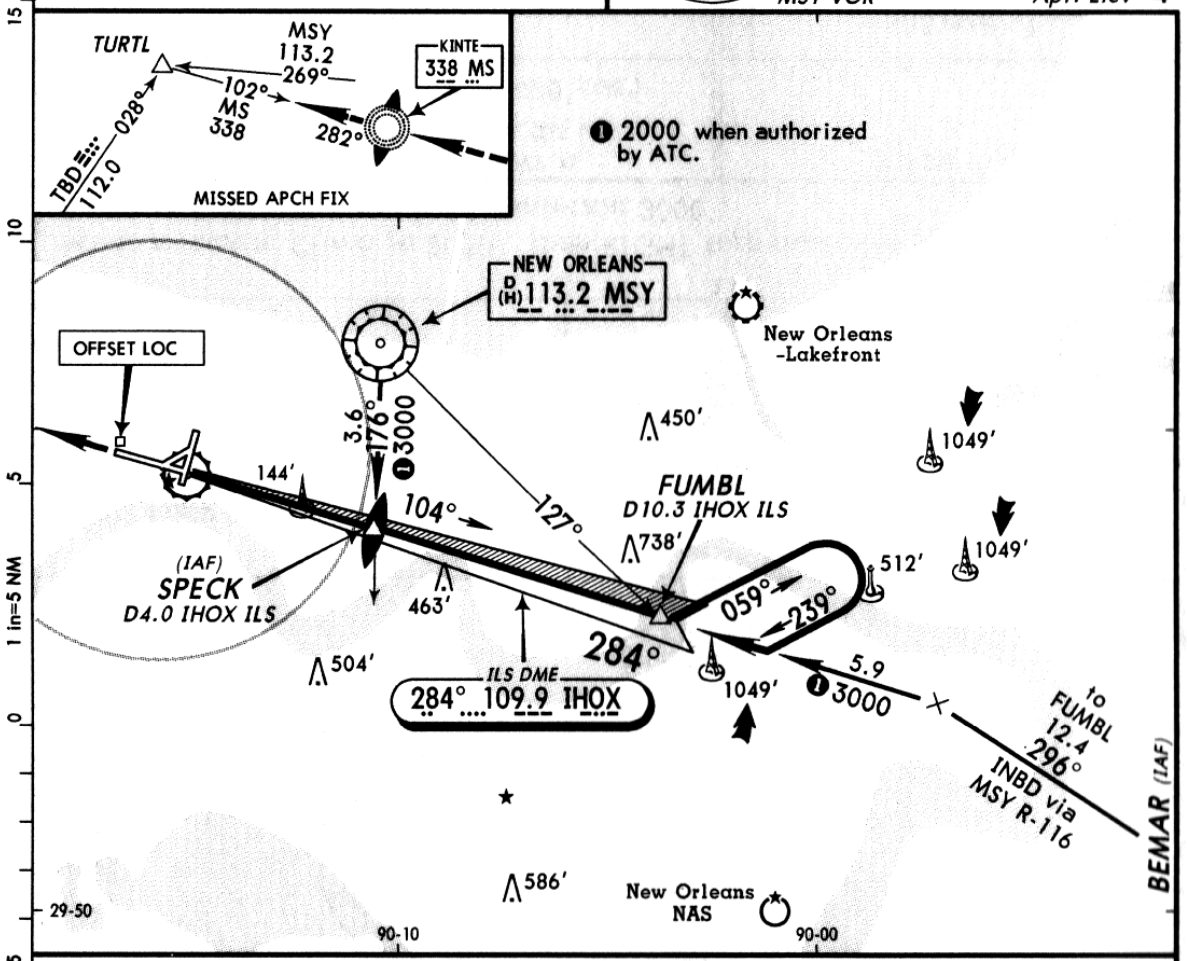
NEW ORLEANS, LA
NEW ORLEANS INTL
ILS Rwy 28

LOC 109.9 IHOX

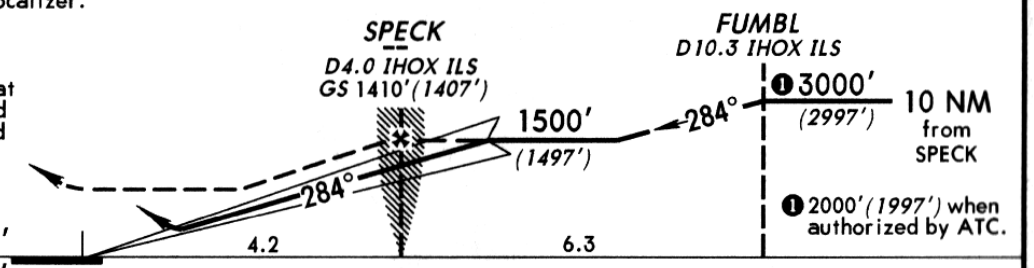
Apt. Elev 4'

ATIS Arrival 127.55
NEW ORLEANS Approach (R) 125.5
MOISANT Tower 119.5
Ground 121.9

2100'
MSA
MSY VOR



Offset localizer.



MISSED APPROACH: Climbing to 2000' direct MS LOM then via bearing 282° to TURTL INT.

STRAIGHT-IN LANDING RWY 28				CIRCLE-TO-LAND	
ILS		LOC (GS out)			
DA(H) 253' (250')		MDA(H) 400' (397')			
RAIL or ALS out		RAIL out	ALS out	Max Kts	MDA(H)
A	RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1	90	460'(456')-1
B				120	480'(476')-1
C				140	480'(476')-1½
D		RVR 40 or ¾	RVR 60 or 1¼	165	700'(696')-2¼

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	376	484	538	645	753	860
SPECK to MAP 4.2	3:36	2:48	2:31	2:06	1:48	1:34

AMEND 1

CHANGES: Straight-in visibilities.

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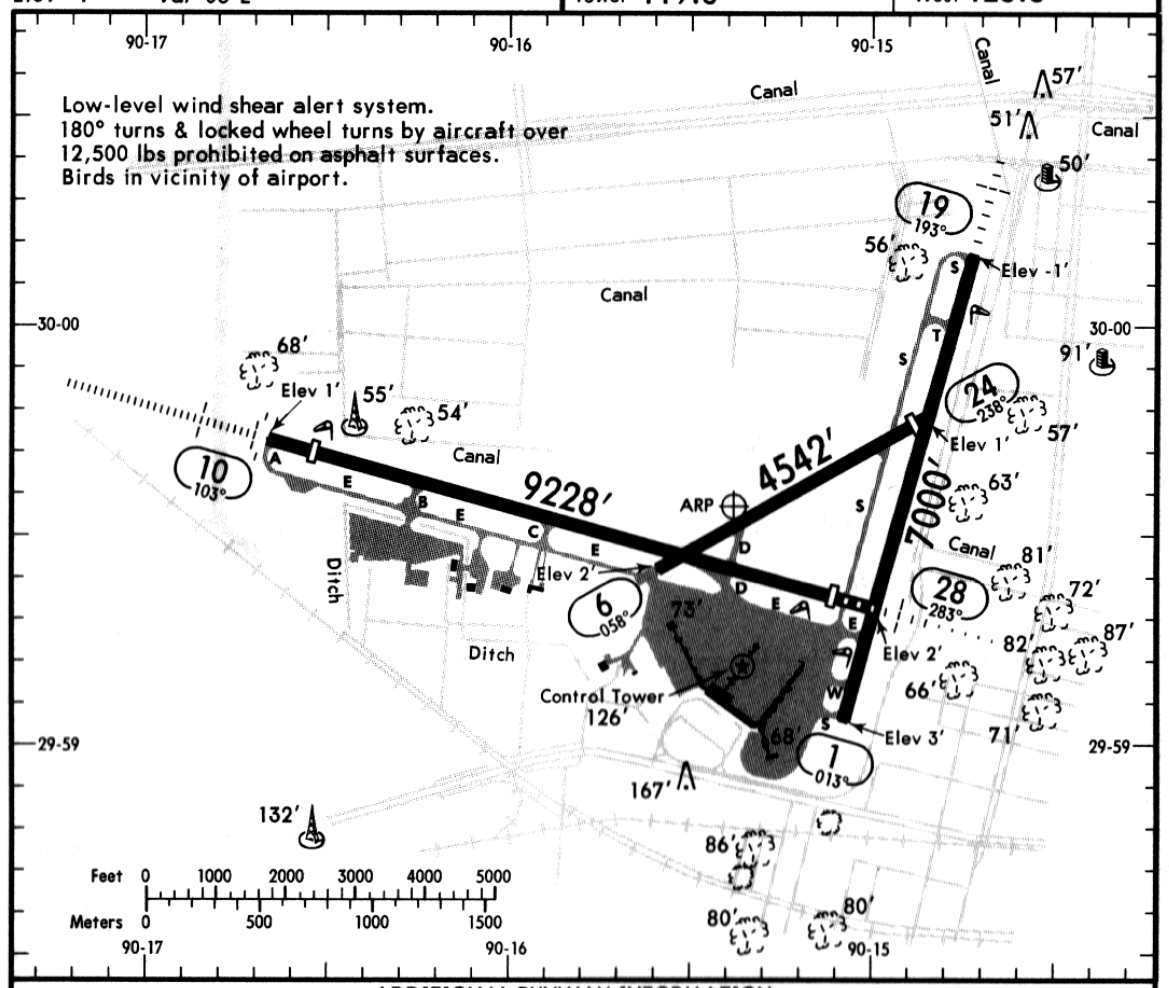
NEW ORLEANS, LA KMSY
NEW ORLEANS INTL

(11-1) APR 6-90 JEPPESEN

N29 59.6 W090 15.4 237.4°/4.9 From MSY 113.2
Elev 4' Var 03°E

ATIS Departure 126.7
MOISANT Clearance (Cpt) 127.2
Ground 121.9
Tower 119.5

NEW ORLEANS Departure (R)
North & East 120.6
SE & South 123.85
West 125.5



ADDITIONAL RUNWAY INFORMATION

RWY			USABLE LENGTHS — LANDING BEYOND — Threshold	Glide Slope	TAKE-OFF	WIDTH
1	HIRL CL LDIN	grooved RVR		5931'		150'
19	HIRL CL MALS VASI (3 bar)-L	grooved RVR				
6 ❶ 24	HIRL					150'
	HIRL VASI-L		4266'			
10 ❷ 28	HIRL CL ALSF-I TDZ ❸VASI-L	grooved RVR	8528'			150'
	HIRL CL MALSR VASI-L	grooved RVR	8527'	7520'		

❶ Closed to aircraft 25,000 lbs & over.
❷ First 228' of rwy 28 available only for take-off at reduced power with Twr approval.
❸ (3 bar) Upwind angle 3.05°, downwind angle 2.8°.

TAKE-OFF

	Rwys 1, 10, 19			Rwy 28			
	CL & RCLM any RVR out, other two req.	Adequate Vis Ref	STD	CL & RCLM any RVR out, other two req.	With Mim climb of 350'/NM to 300' Adequate Vis Ref	STD	Other
1 & 2 Eng	TDZ RVR 6 Mid RVR 6	RVR 16 or ¼	RVR 50 or 1	TDZ RVR 6 Mid RVR 6	RVR 16 or ¼	RVR 50 or 1	300-1½
3 & 4 Eng	Rollout RVR 6		RVR 24 or ½	Rollout RVR 6		RVR 24 or ½	

TAKE-OFF Rwys 6, 24			FOR FILING AS ALTERNATE			
	Adequate Vis Ref	STD		ILS Rwy 1	ILS Rwy 28	LOC BC Rwy 19 LOC Rwy 28	Other
1 & 2 Eng	¼	1	A	600-2	600-2	800-2	800-2
3 & 4 Eng		½	B				
			C				
			D	700-2	700-2¼	800-2¼	

AMEND 0

CHANGES: Runway 28 note.

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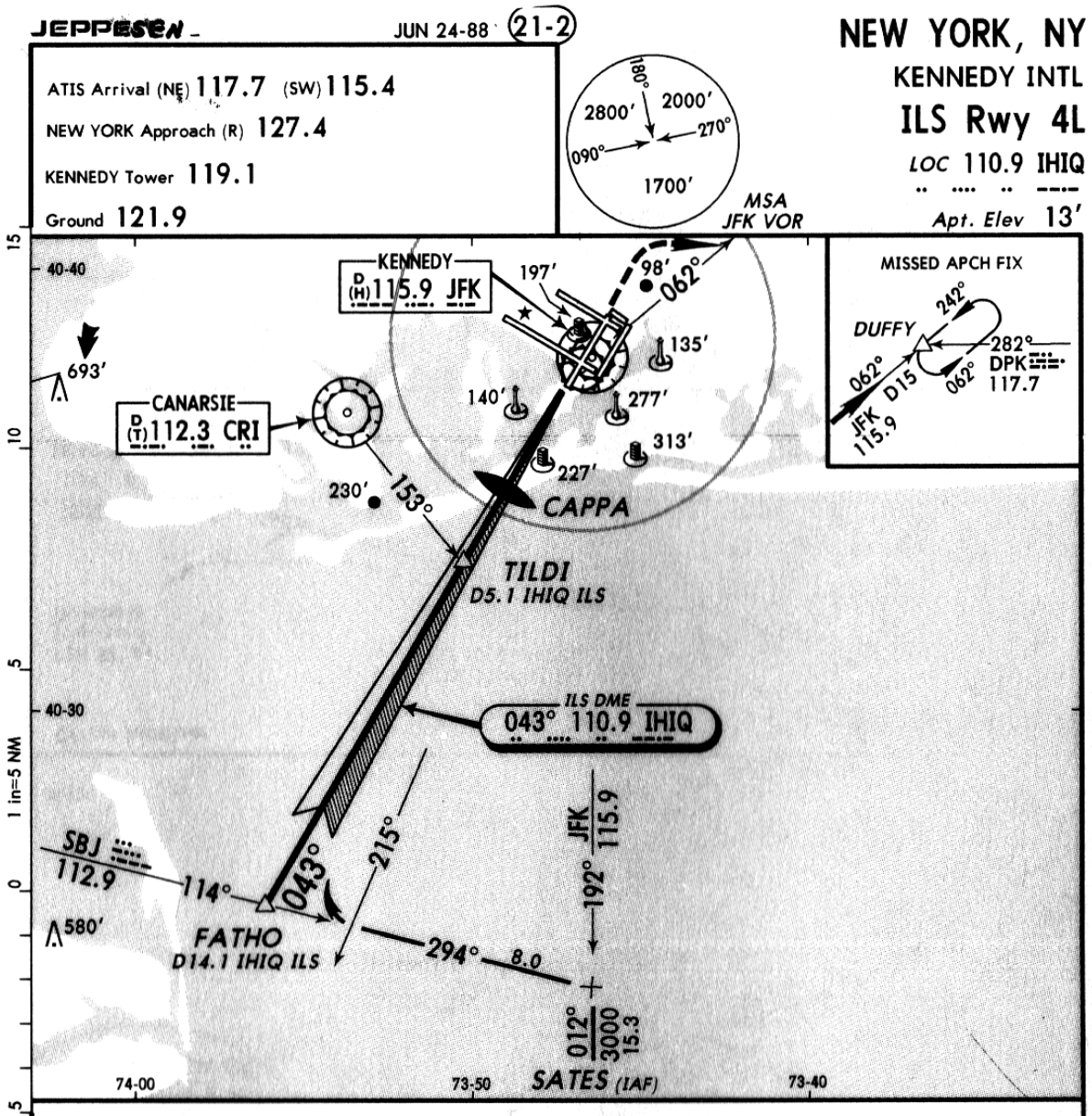
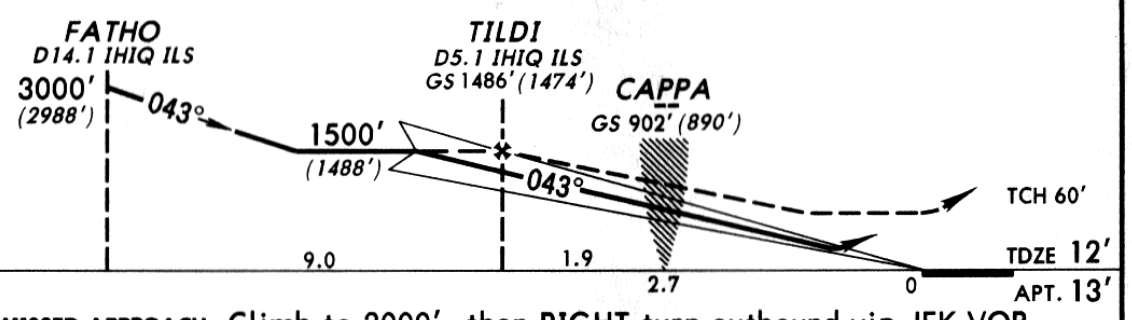
JEPPESEN JUN 24-88 (21-2)

NEW YORK, NY
KENNEDY INTL
ILS Rwy 4L

LOC 110.9 IHIQ
Apt. Elev 13'

ATIS Arrival (NE) 117.7 (SW) 115.4
NEW YORK Approach (R) 127.4
KENNEDY Tower 119.1
Ground 121.9





MISSED APPROACH: Climb to 2000', then RIGHT turn outbound via JFK VOR R-062 to DUFFY INT and hold. Maintain 3000'.

STRAIGHT-IN LANDING RWY 4L			CIRCLE-TO-LAND	
ILS		LOC (GS out)		
DH 262' (250')		MDA 400' (388')		MDA
A	RVR 40 or ¾	RVR 50 or 1	A	580' (567') - 1
B			B	
C			C	580' (567') - 1½
D		RVR 60 or 1¼	D	620' (607') - 2

Gnd speed-Kts		70	90	100	120	140	160
GS	2.86°	360	462	514	616	719	822
TILDI to MAP	4.6	3:57	3:04	2:46	2:18	1:58	1:44

AMEND 6

CHANGES: Sates approach transition added, profile note removed.

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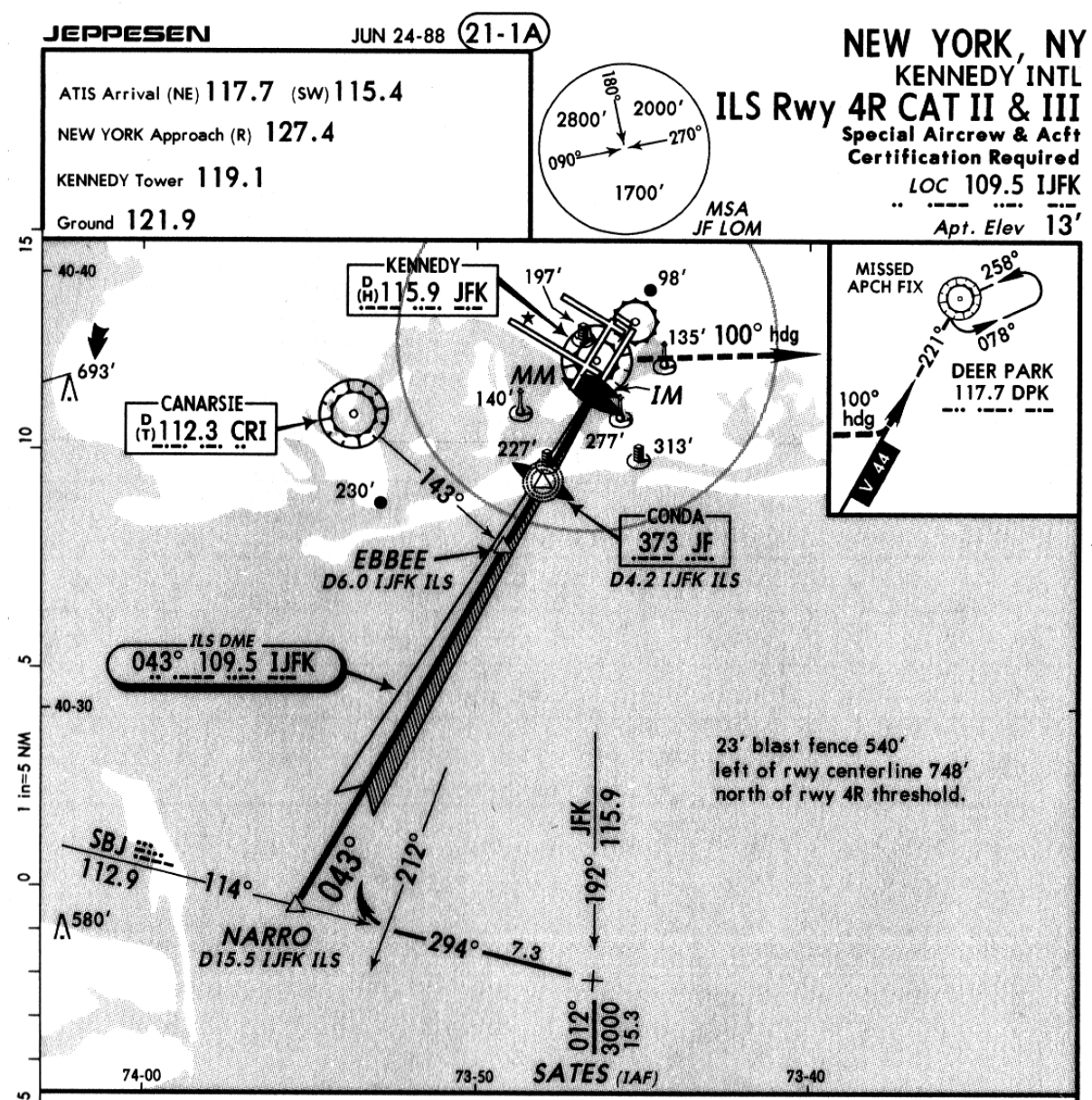
JEPPESEN JUN 24-88 (21-1A)

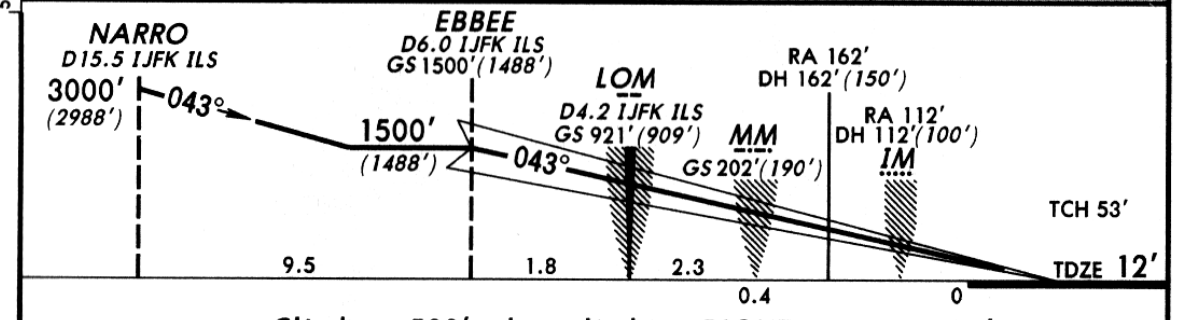
NEW YORK, NY
KENNEDY INTL
ILS Rwy 4R CAT II & III

Special Aircrew & Acft Certification Required

LOC 109.5 IJFK
Apt. Elev 13'

ATIS Arrival (NE) 117.7 (SW) 115.4
NEW YORK Approach (R) 127.4
KENNEDY Tower 119.1
Ground 121.9





MISSED APPROACH: Climb to 500', then climbing RIGHT turn to 4000' via heading 100° and V-44 to DPK VOR and hold.

STRAIGHT-IN LANDING RWY 4R				
CAT IIIB ILS	CAT IIIA ILS	CAT II ILS		
		RA 112' DH 112' (100')	RA 162' DH 162' (150')	
RVR 6	RVR 7	RVR 12	RVR 16	

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862

AMEND 28

CHANGES: Sates approach transition added, profile note removed.

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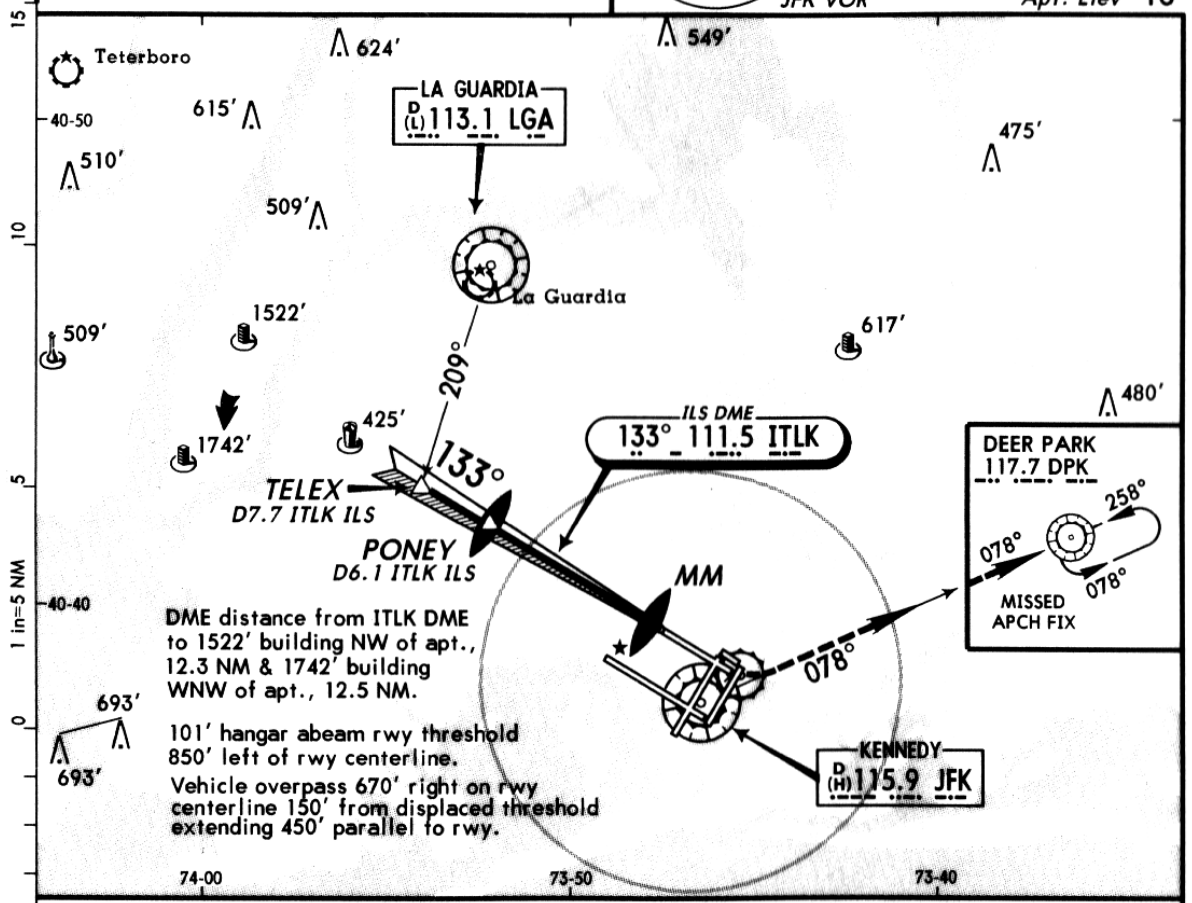
JEPPESEN MAY 25-90 (21-3A) Eff May 31

NEW YORK, NY
KENNEDY INTL
ILS Rwy 13L CAT II
Special Aircrew & Acft Certification Required

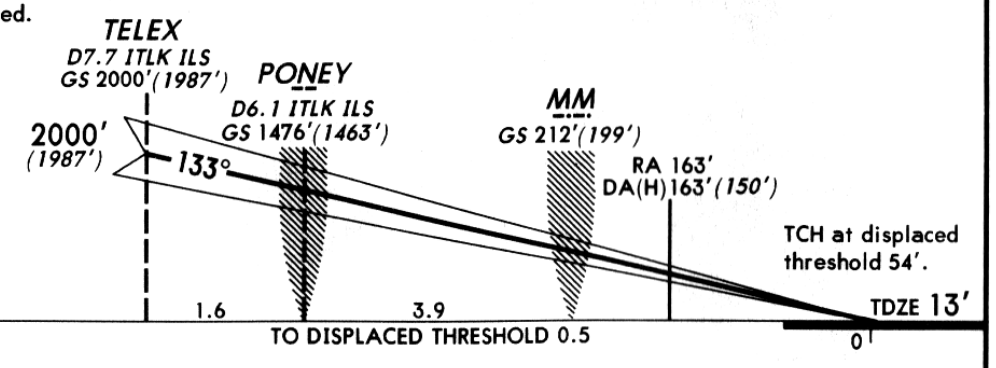
ATIS Arrival 128.72 (NE) 117.7 (SW) 115.4
NEW YORK Approach (R) 127.4
KENNEDY Tower 119.1
Ground 121.9

MSA JFK VOR: 180°–2000′, 270°–2800′, 090°–1700′

LOC 111.5 ITLK
Apt. Elev 13′



Radar required.



MISSED APPROACH: Climb to 500′ then climbing LEFT turn to 4000′ outbound via JFK VOR R-078 to DPK VOR and hold.

STRAIGHT-IN LANDING RWY 13L
CAT II ILS
RA 163′
DA(H) 163′(150′)

RVR 16

Gnd speed-Kts		*70*	*90*	*100*	*120*	*140*	*160*
GS	3.00°	377	484	538	646	753	861

AMEND 14

CHANGES: Planview notes, Telex Int formation, TCH.

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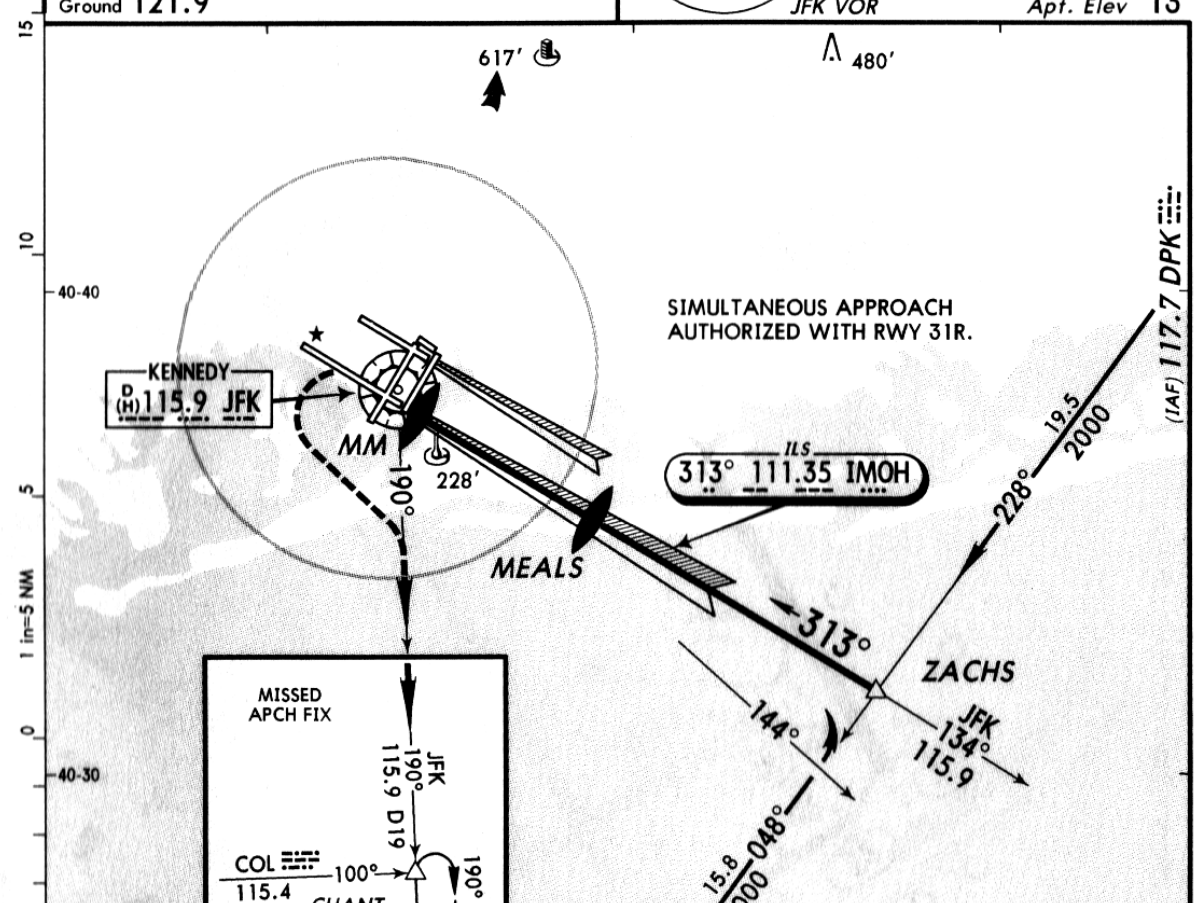
JEPPESEN MAR 30-90 (21-6)

NEW YORK, NY
KENNEDY INTL
ILS Rwy 31L

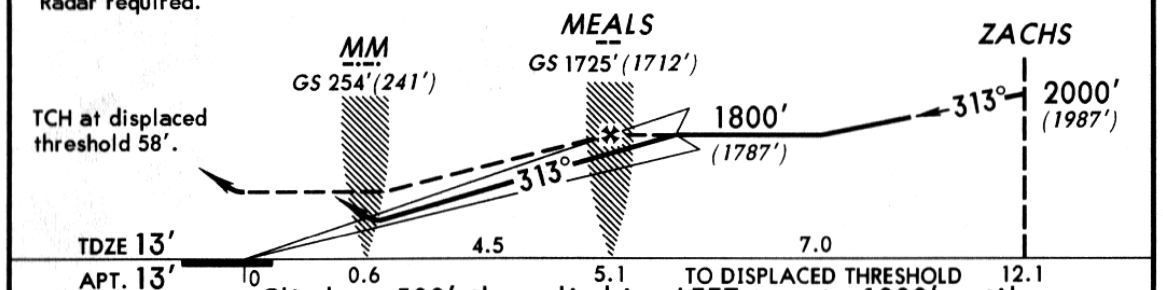
ATIS Arrival 128.72 (NE) 117.7 (SW) 115.4
NEW YORK Approach (R) 127.4
KENNEDY Tower 119.1
Ground 121.9

MSA JFK VOR: 180°–2000′, 270°–2800′, 090°–1700′

LOC 111.35 IMOH
Apt. Elev 13′



Radar required.



MISSED APPROACH: Climb to 500′ then climbing LEFT turn to 1000′ until intercepting outbound JFK VOR R-190, then climb to 3000′ outbound via JFK VOR R-190 to CHANT INT/D19.0 and hold.

STRAIGHT-IN LANDING RWY 31L

	ILS DA(H) 263′(250′) FULL	ILS DA(H) 263′(250′) MM out	LOC (GS out) MDA(H) 460′(447′)	CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
A	RVR 40 or ¾		RVR 50 or 1	90	580′(567′)-1
B				120	
C			RVR 60 or 1¼	140	580′(567′)-1½
D			1½	165	620′(607′)-2

Gnd speed-Kts		*70*	*90*	*100*	*120*	*140*	*160*
GS	3.00°	378	486	540	648	756	864
MEALS to MAP	5.1	4:22	3:24	3:04	2:33	2:11	1:55

AMEND 7

CHANGES: Localizer DME removed.

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JEPPESEN

ATIS Departure 115.1	NEW YORK Departure (R) 135.9
KENNEDY Clearance (Cpt) 135.05	
Ground 121.9	
Tower 119.1	VOT 115.1

NEW YORK, NY
KENNEDY INTL

JFK 115.9 - On Airport N40 38.4 W073 46.7
Var 13°W *Elev* 13′

MANDATORY SIGN: A sign which, if ignored, could cause a hazard involving acft in flight. These signs are usually located at rwy intersections and are color-coded with a silver legend and border on a red background.

INFORMATIONAL SIGN: A sign which enables a pilot to efficiently determine locations and, if ignored, could cause a hazard to taxiing acft. These signs are usually located at taxiway intersections and are color-coded with a black legend on a yellow background.

CONVENIENCE SIGN: A sign to direct pilots to aprons and specific locations and positions such as terminal or apron areas. These signs are color-coded with a legend and border of silver on a green background.

LDIN (21 sequenced flashers 100′ apart)
LDIN (5 sequenced flashers)
LDIN (6 sequenced flashers)
LDIN (7 sequenced flashers)
CARGO AREA
NORTH PASSENGER TERMINAL
GENERAL AVIATION
INTL ARRIVAL TERMINAL
Control Tower 197′
Blast Fence
Elev 12′
Elev 11′
10,000′
2560′
14,572′
11,351′
8400′
13L 134
13R 134
14 138
22R 224
32 318
31R 314
22L 224
31L 314
4R 044
4L 044
Taxiway "I" between NA & NB closed to DC-8 series 70 aircraft.
O = Outer Perimeter
I = Inner Perimeter
Inner Taxi = Clockwise
Outer Taxi = Counterclockwise
Red/Green controllable stop bar
CAT II HOLDING
LLWAS
NW NE SE W SW CF
Feet 0 1000 2000 3000 4000
Meters 0 200 400 600 800 1000 1200

CHANGES: Taxiway XA redesignated AA.

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JEPPESEN AUG 11-89 (11-3)

PHILADELPHIA, PA

PHILADELPHIA INTL

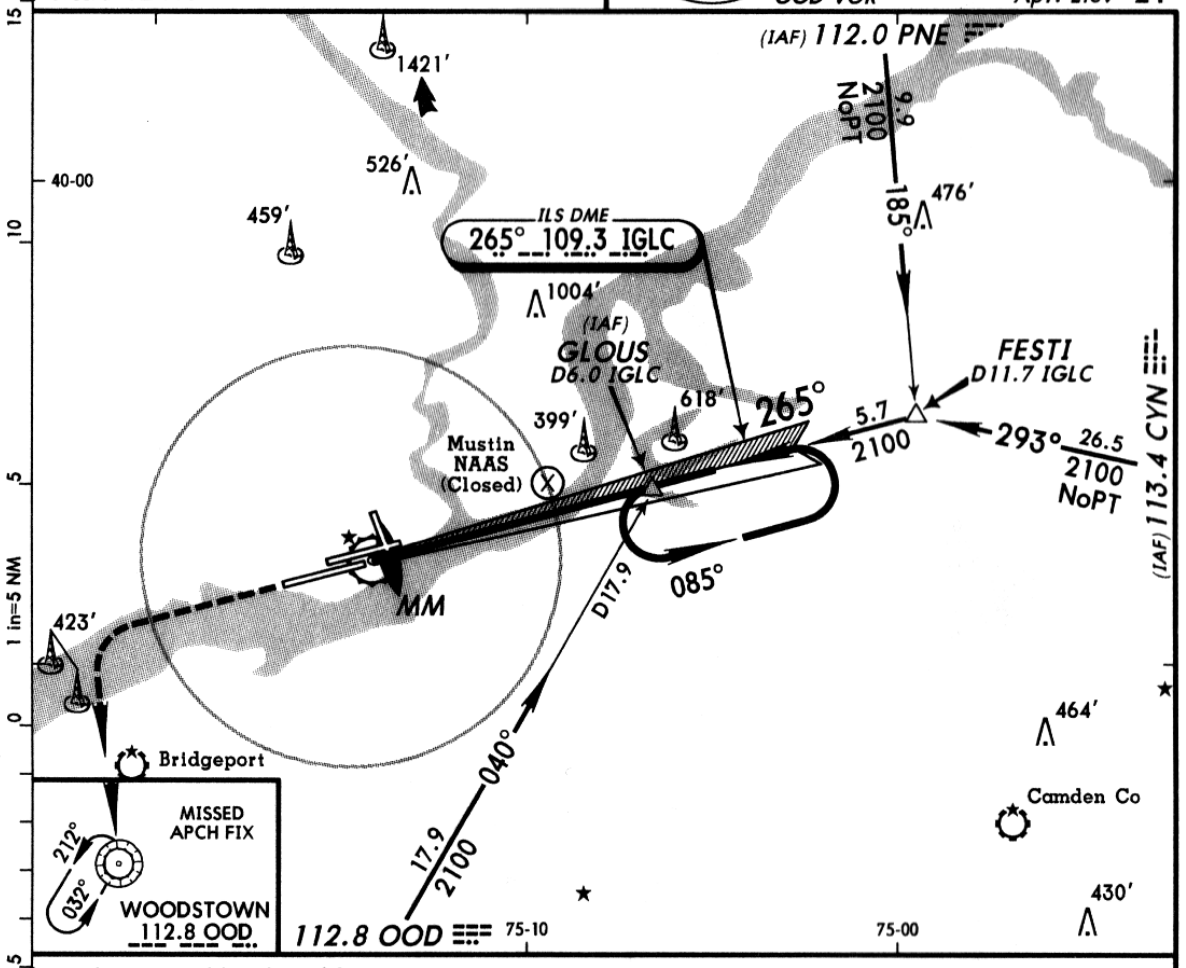
ILS Rwy 27L

LOC 109.3 IGLC

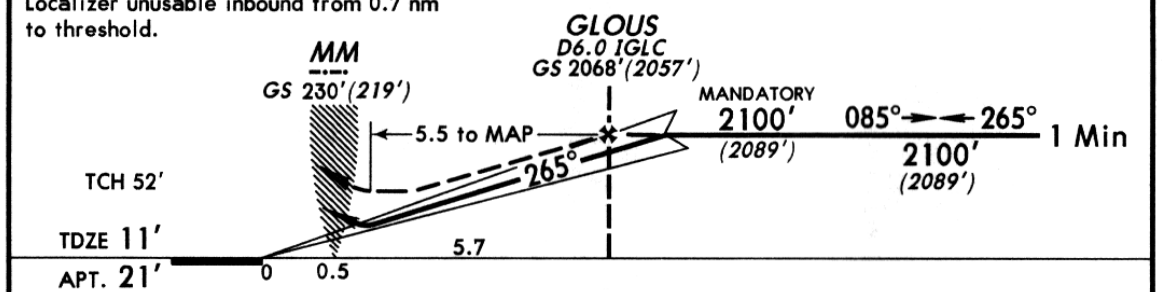
Apt. Elev 21′

ATIS 133.4
PHILADELPHIA Approach (R) 128.4
PHILADELPHIA Tower 118.5
Ground 121.9

2500′



Localizer unusable inbound from 0.7 nm to threshold.



MISSED APPROACH: Climb to 1500′, then climbing LEFT turn to 2000′ direct OOD VOR and hold.

STRAIGHT-IN LANDING RWY 27L	ILS DA(H) 282′ (271′)			LOC (GS out) MDA(H) 660′ (649′)		CIRCLE-TO-LAND	
	FULL	RAIL or ALS out	MM out		RAIL or ALS out	Max Kts	MDA(H)
A	RVR 24 or ½	RVR 50 or 1	RVR 24 or ½	RVR 24 or ½	RVR 50 or 1	90	660′(639′)-1
B						120	
C				RVR 60 or 1¼	1¾	140	660′(639′)-1¾
D			RVR 40 or ¾	1½	2	165	660′(639′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	379	487	541	649	757	866
GLOUS to MAP 5.5	4:43	3:40	3:18	2:45	2:21	2:04

AMEND 5

CHANGES: Glous & festi Ints redesignated, LOC MAP, minimums.

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JEPPESEN AUG 11-89 (11-2)

PHILADELPHIA, PA

PHILADELPHIA INTL

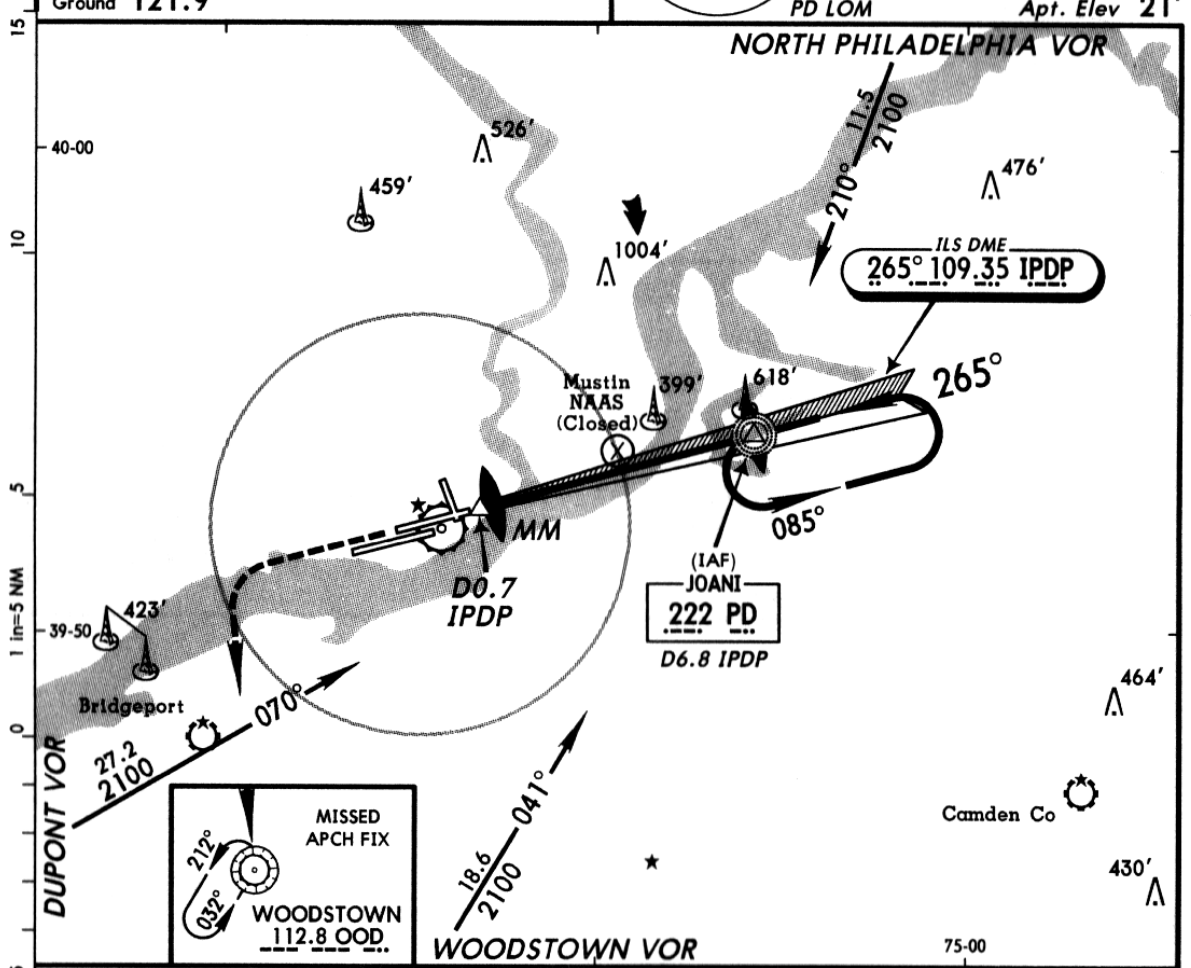
ILS Rwy 27R

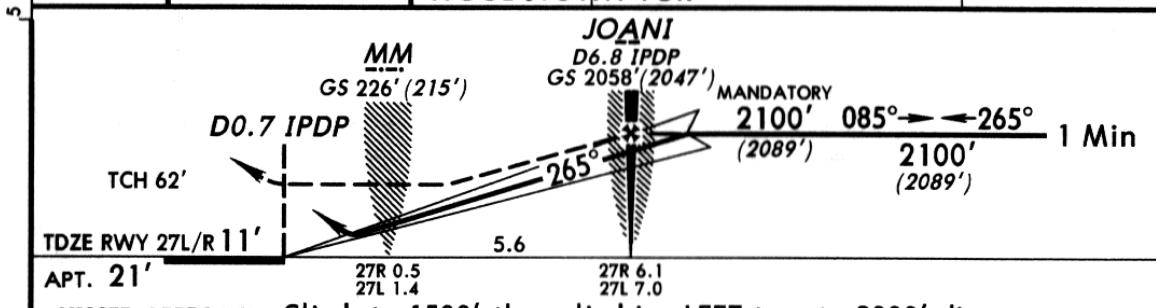
LOC 109.35 IPDP

Apt. Elev 21′

ATIS 133.4
PHILADELPHIA Approach (R) 128.4
PHILADELPHIA Tower 118.5
Ground 121.9

2500′





MISSED APPROACH: Climb to 1500′ then climbing LEFT turn to 2000′ direct OOD VOR and hold.

STRAIGHT-IN LANDING RWY 27R	ILS DA(H) 211′(200′)			LOC (GS out) MDA(H) 660′ (649′)			SIDESTEP LANDING RWY 27L MDA(H) 660′ (649′)	CIRCLE-TO-LAND	
	FULL	RAIL or ALS out	MM out		RAIL out	ALS out		Max Kts	MDA(H)
A	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	1	90	660′(639′)-1
B								120	
C				RVR 60 or 1¼	1¾		1¾	140	660′(639′)-1¾
D			RVR 40 or ¾	1½	2		2	165	660′(639′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	379	487	541	649	757	865
MAP at D0.7 IPDP or JOANI to MAP 6.1	5:14	4:04	3:40	3:03	2:37	2:17

AMEND 6

CHANGES: See other side.

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JEPPESEN AUG 18-89 (10-9)

AIRPORT

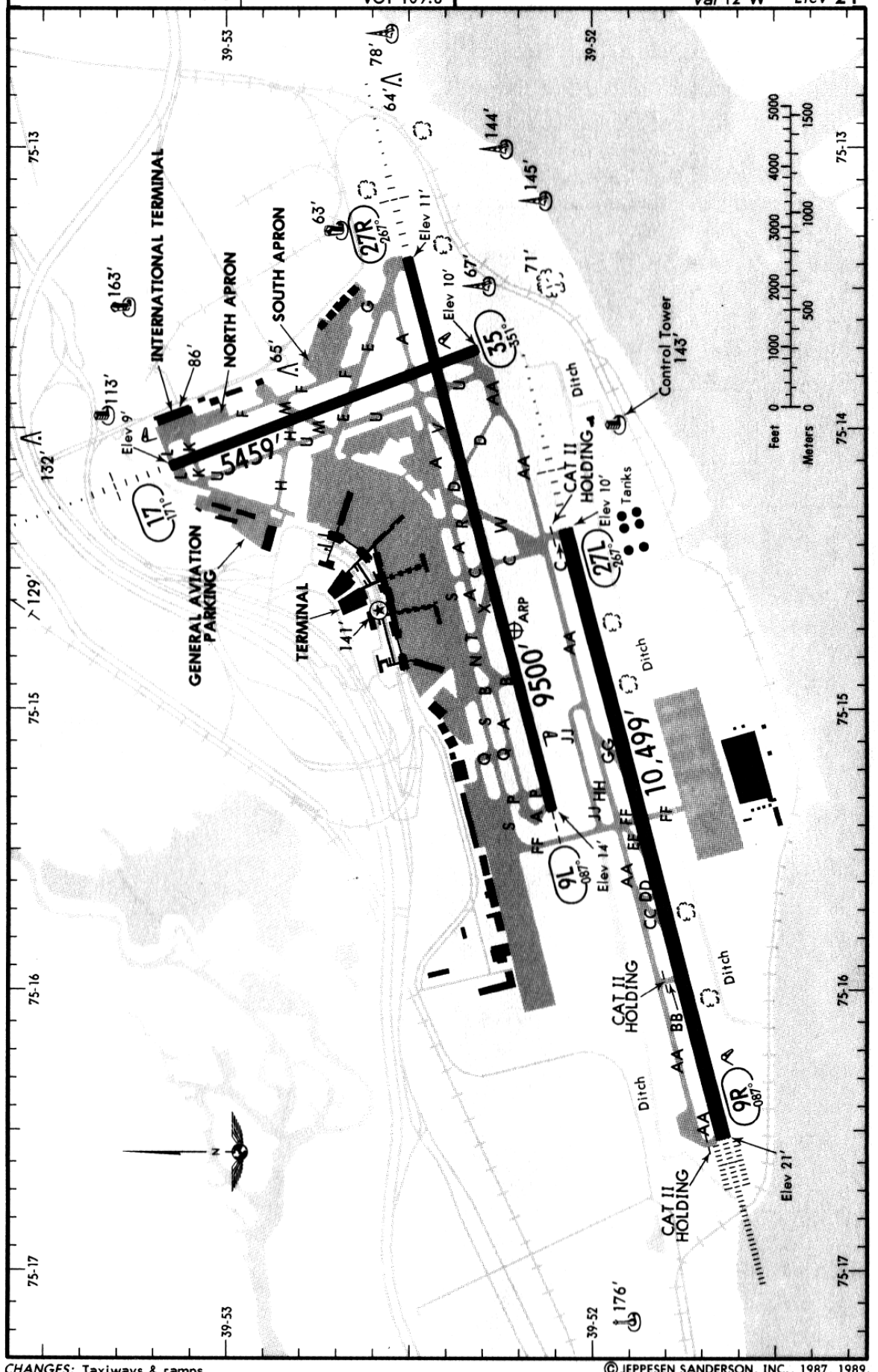
KPHL

PHILADELPHIA, PA
PHILADELPHIA INTL

ATIS 133.4
PHILADELPHIA Clearance (Cpt) 118.85
Ground 121.9 Tower 118.5

PHILADELPHIA Departure (R)
270°-089° 124.35
090°-269° 119.75
VOT 109.8

020.8°/14.3 From OOD 112.8 N39 52.2 W075 14.7
Var 12°W Elev 21'



CHANGES: Taxiways & ramps.

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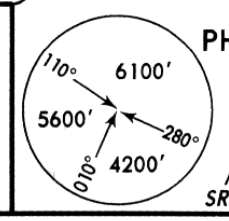
JEPPESEN DEC 22-89 (11-1)

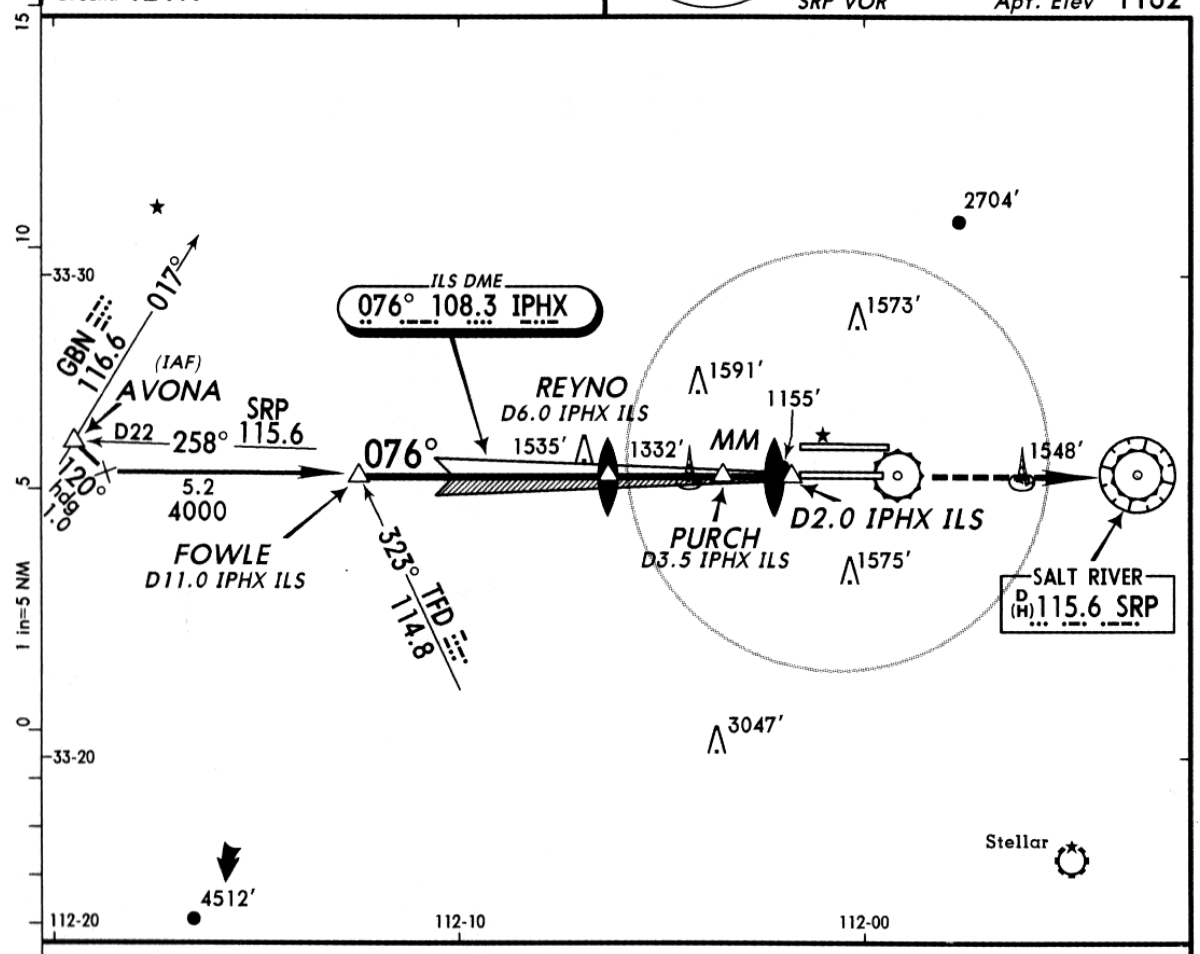
PHOENIX, ARIZ
PHOENIX SKY HARBOR INTL
ILS Rwy 8R

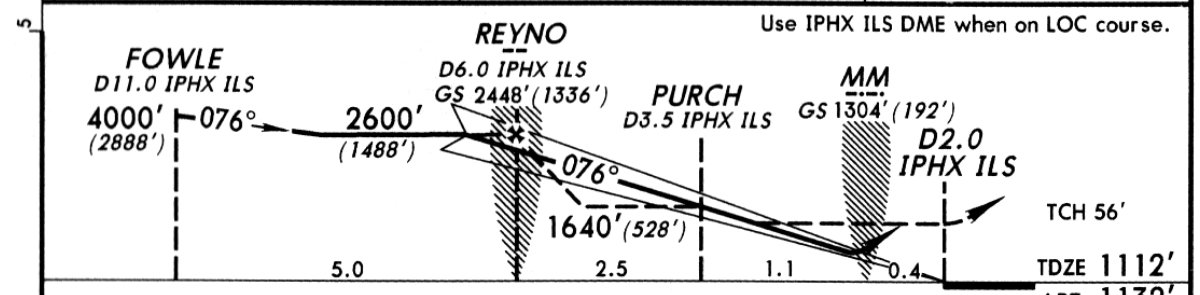
ATIS Arrival 121.2
PHOENIX Approach (R) 120.7
PHOENIX Tower Rwy 8L-26R 118.7
Rwy 8R-26L 120.9
Ground 121.9



MSA SRP VOR

LOC 108.3 IPHX
Apt. Elev 1132'





MISSED APPROACH: Climb to 5000' direct SRP VOR.

STRAIGHT-IN LANDING RWY 8R

	ILS DA(H) 1312' (200') FULL	ILS DA(H) 1312' (200') RAIL or ALS out	ILS DA(H) 1362' (250') MM out	LOC (GS out) MDA(H) 1420' (308') With Purch MM out	LOC (GS out) MDA(H) 1420' (308') With Purch RAIL out	LOC (GS out) MDA(H) 1420' (308') With Purch ALS out	LOC (GS out) MDA(H) 1640' (528') Without Purch			CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
A	1/2	3/4	1/2	1/2	3/4	1	1/2	3/4	1	90	1640' (508')-1
B										120	
C							1	1 1/2		140	1660' (528')-1 1/2
D			3/4	3/4	1		1 1/4	1 3/4		165	1880' (748')-2 1/2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	376	484	537	645	752	860
MAP at D2.0 IPHX or REYNO to MAP 4.0	3:26	2:40	2:24	2:00	1:43	1:30

AMEND 7

CHANGES: See other side.

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PHOENIX, ARIZ

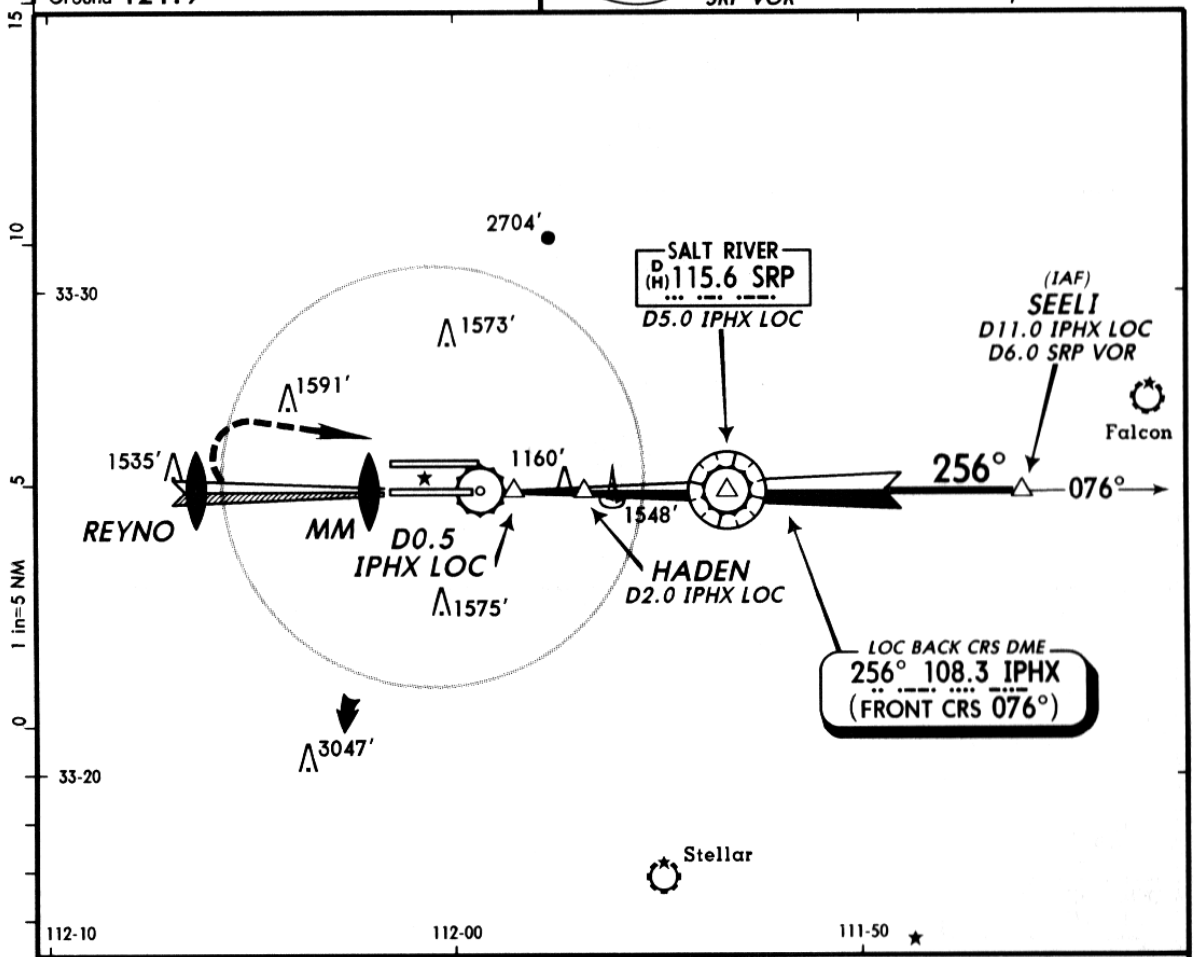
PHOENIX SKY HARBOR INTL

LOC (BACK CRS) Rwy 26L

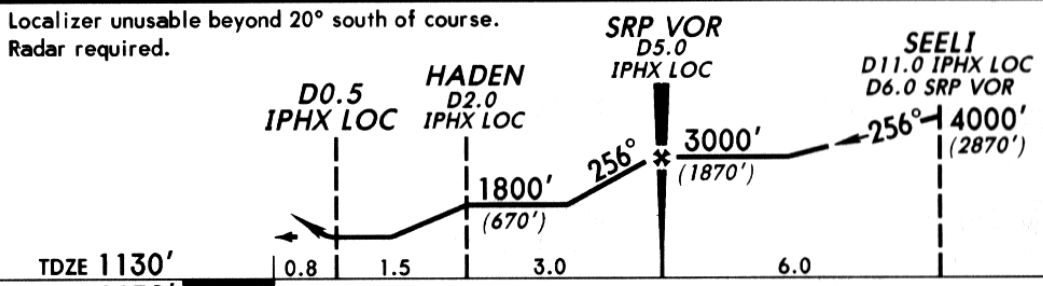
ATIS Arrival 121.2
PHOENIX Approach (R) 120.7
PHOENIX Tower Rwy 8L-26R 118.7
Rwy 8R-26L 120.9
Ground 121.9

LOC 108.3 IPHX
Apt. Elev 1132′

MSA
SRP VOR
110° 6100′
280° 4200′
010° 5600′



Localizer unusable beyond 20° south of course.
Radar required.



MISSED APPROACH: Climb to 3000′ then climbing RIGHT turn to 6000′ direct SRP VOR.

STRAIGHT-IN LANDING RWY 26L			CIRCLE-TO-LAND		
	MDA(H) 1420′ (290′) With Haden	MDA(H) 1800′ (670′) Without Haden	Max Kts	With Haden MDA(H)	Without Haden MDA(H)
A	1	1	90	1640′ (508′)-1	1800′ (668′)-1
B			120		
C		1¾	140	1660′ (528′)-1½	1800′ (668′)-1¾
D		2	165	1880′ (748′)-2½	1880′ (748′)-2½

Gnd speed-Kts	70	90	100	120	140	160
MAP at D0.5 or VOR/D5.0 to MAP 4.5	3:51	3:00	2:42	2:15	1:56	1:41

AMEND 5

CHANGES: Profile note, minimums.

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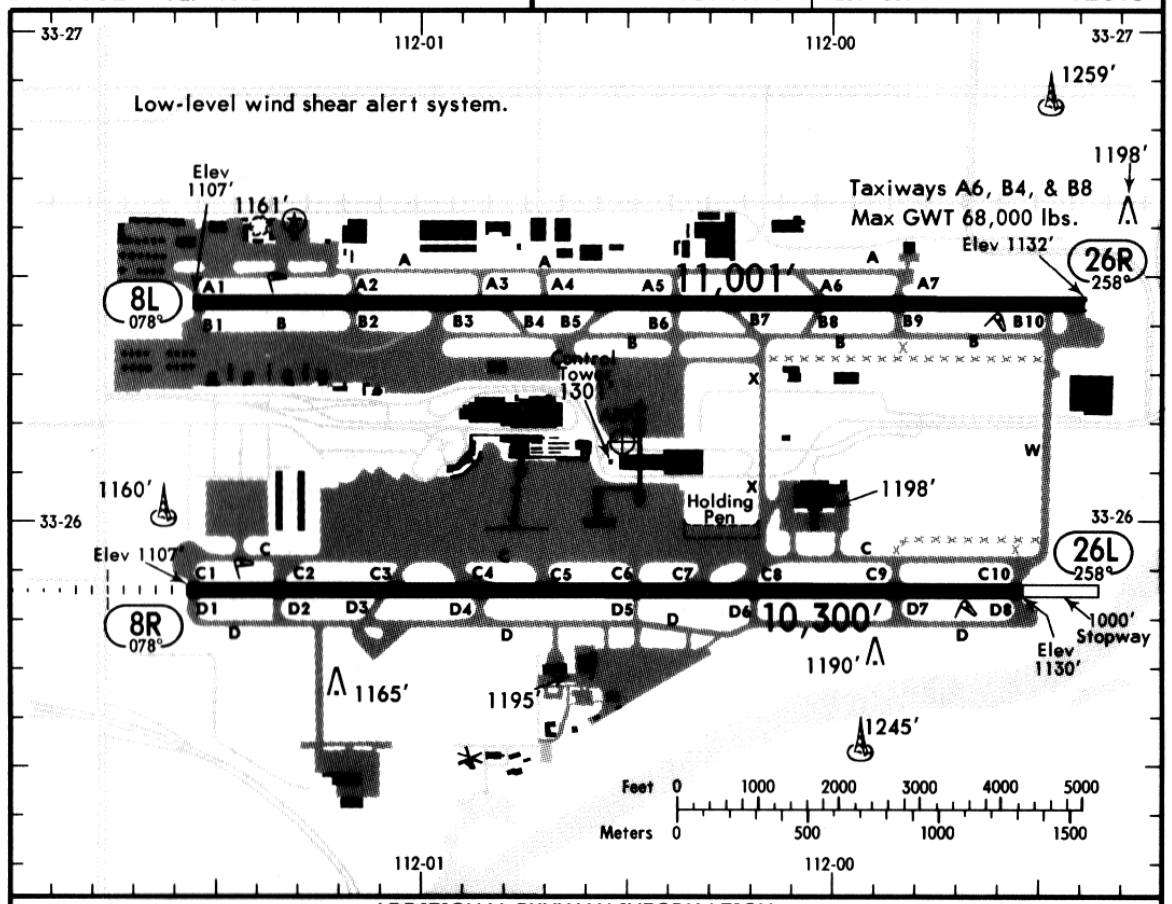
PHOENIX, ARIZ KPHX

PHOENIX SKY HARBOR INTL

N33 26.2 W112 00.5 258.7°/6.1 From SRP 115.6
Elev 1132′ Var 13°E

		PHOENIX Departure (R)	
ATIS Departure	124.3	310°-052° 5500′ & below	120.7
PHOENIX Clearance	118.1	310°-052° above 5500′	119.2
Ground	121.9	053°-146°	124.9
Tower		147°-258° 5500′ & below	123.7
Rwy 8L-26R	118.7	147°-258° above 5500′	124.1
Rwy 8R-26L	120.9	259°-309°	126.8
VOT	109.0		



ADDITIONAL RUNWAY INFORMATION

RWY			USABLE LENGTHS LANDING BEYOND Threshold	Glide Slope	TAKE-OFF	WIDTH
8R	HIRL MALSR	grooved		9253′		
26L	HIRL REIL VASI (3 bar)-L	grooved				150′
8L	MIRL REIL VASI-L	grooved				150′
26R						150′

TAKE-OFF & IFR DEPARTURE PROCEDURE

	Rwys 8L, 8R		Rwys 26L, 26R					
			If Radar Vectored			If Not Radar Vectored		
	Adequate Vis Ref	STD	With Mim climb of 250′/NM to 1700′ Adequate Vis Ref	STD	Other	With Mim climb of 260′/NM to 5300′ Adequate Vis Ref	STD	Other
1&2 Eng	¼	1	¼	1	3400-2	¼	1	3400-2
3&4 Eng		½		½			½	

FOR FILING AS ALTERNATE

	Precision	Non-Precision
A	600-2	800-2
B		
C		
D	800-2½	800-2½

IFR DEPARTURE PROCEDURE: Rwys 26L & 26R; climb westbound on V-16 to 3000′; if westbound, continue climb on course. All others reverse course, climb direct SRP VOR. Rwys 8L & 8R climb heading 070° to 3000′; then climbing right turn direct SRP VOR or comply with published SID.

AMEND 2

CHANGES: Taxiways & taxiway idents.

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JEPPESEN JAN 12-90 (21-2)

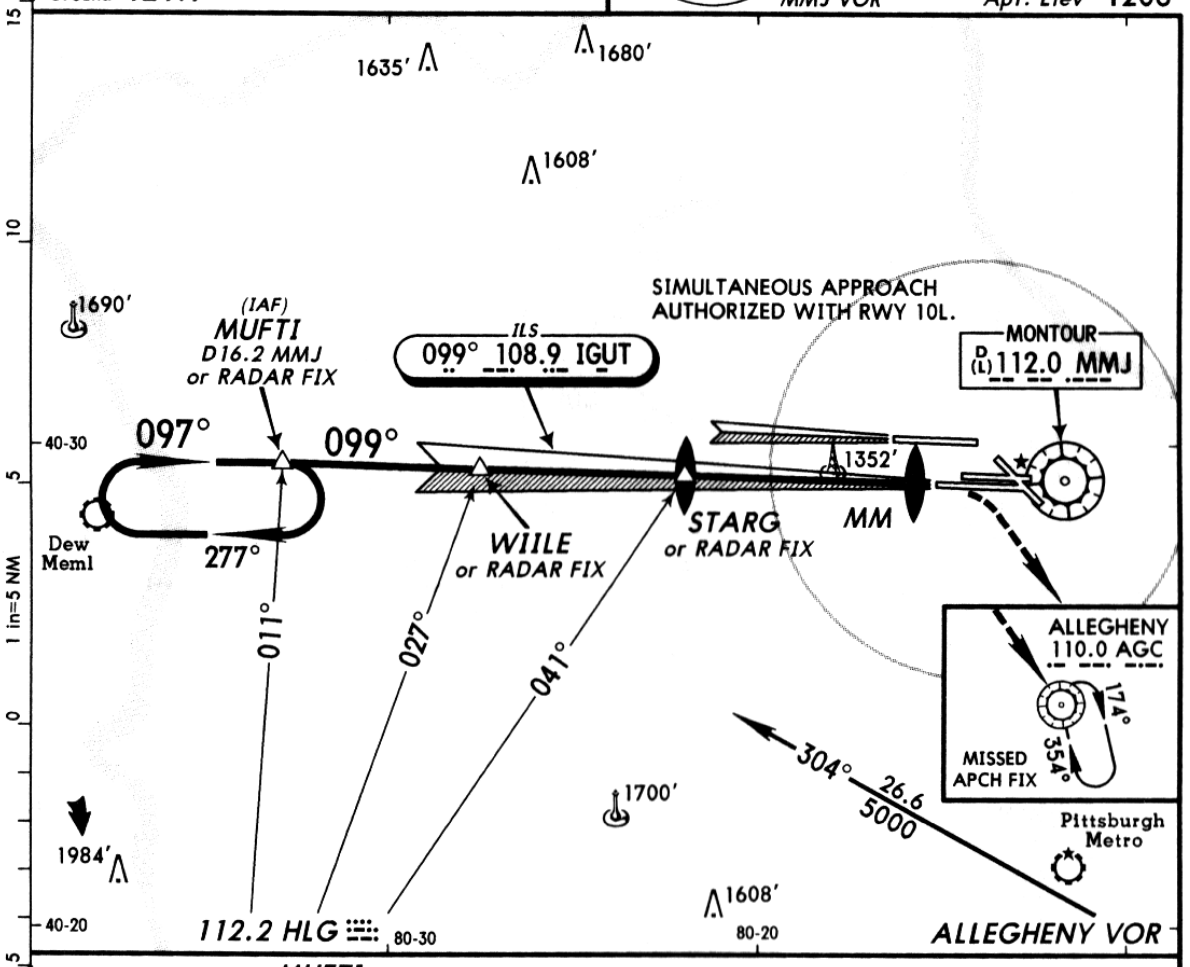
PITTSBURGH, PA
GREATER PITTSBURGH INTL
ILS Rwy 10R

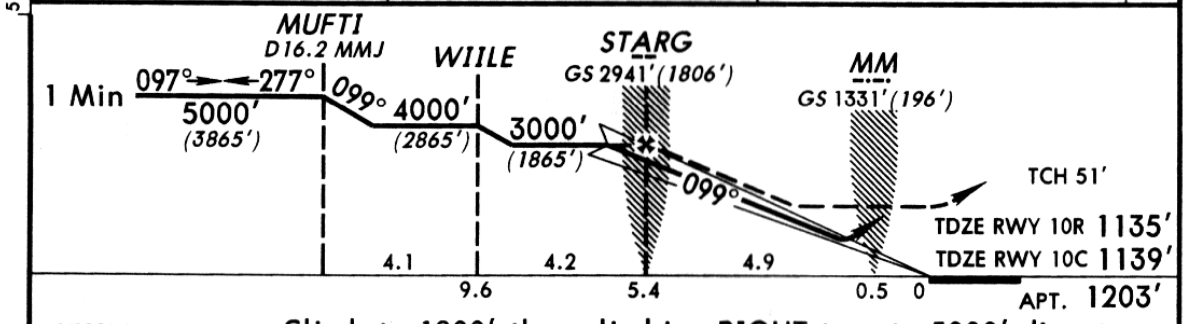
LOC 108.9 IGUT

ATIS Arrival 127.25
PITTSBURGH Approach (R) 123.95
PITTSBURGH Tower Rwys 10L, 28R 128.3
Rwys 10R, 10C, 14, 28L, 28C, 32 119.1
Ground 121.9

3100' MSA MMJ VOR

Apt. Elev 1203'





MISSED APPROACH: Climb to 1800' then climbing RIGHT turn to 5000' direct AGC VOR and hold.

STRAIGHT-IN LANDING RWY 10R	ILS				LOC (GS out)			SIDESTEP LANDING RWY 10C	CIRCLE-TO-LAND	
	DA(H) 1335'(200')			DA(H) 1385'(250')	MDA(H) 1620'(485')			1 MDA(H) 1620'(481')	Max Kts	MDA(H)
	FULL	TDZ or CL out	RAIL or ALS out	MM out		RAIL out	ALS out			
A	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	RVR 50 or 1	90	1700'(497')-1
B									120	
C					RVR 40 or 3/4	RVR 60 or 1 1/4		1 1/2	140	1700'(497')-1 1/2
D				RVR 40 or 3/4	RVR 50 or 1	1 1/2		2	165	1760'(557')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
STARG to MAP	5.4	4:38	3:36	3:14	2:42	2:19	2:02

1 CAT D: MDA(H) 1700'(561').

AMEND 5

CHANGES: Straight-in ILS minimums.

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JEPPESEN OCT 21-88 (21-4)

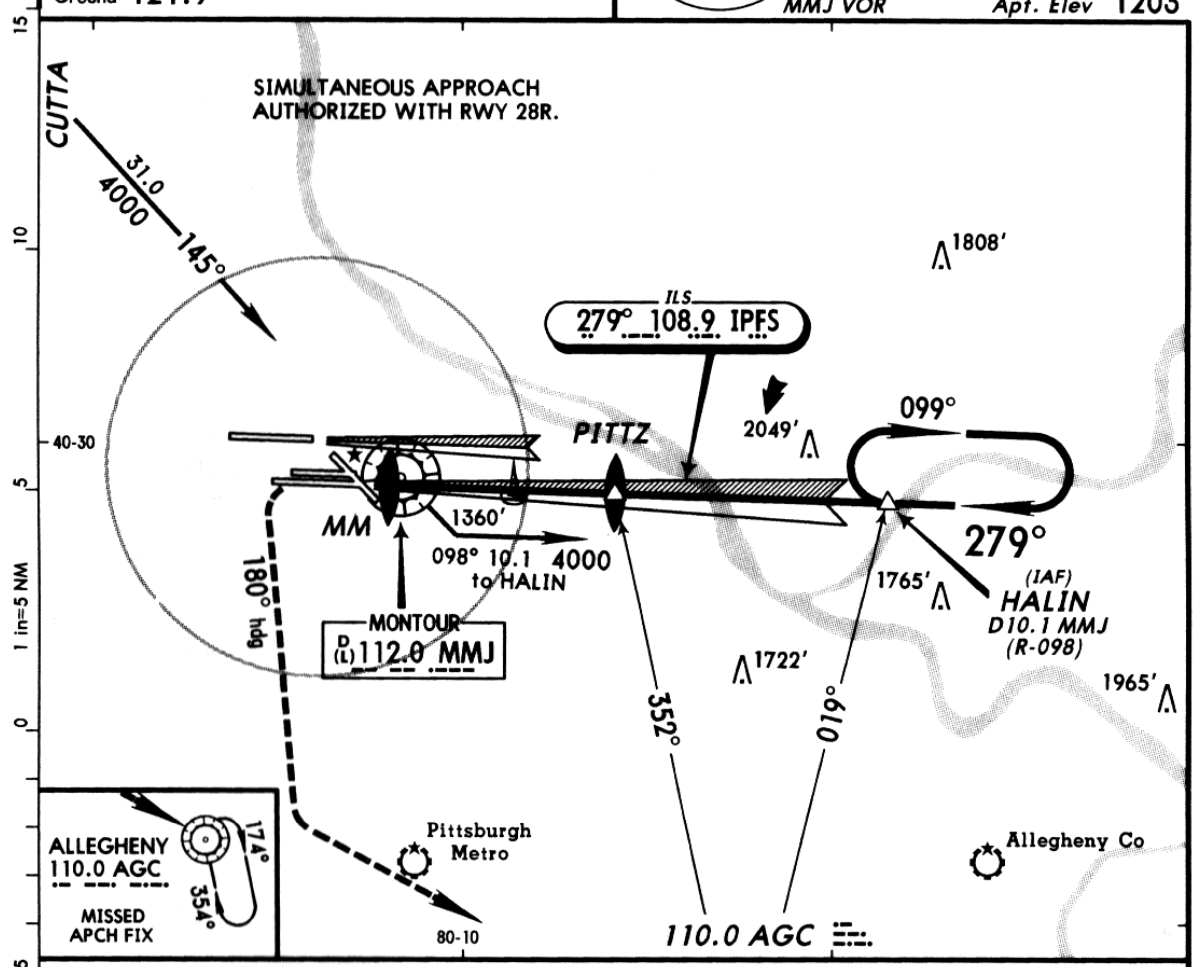
PITTSBURGH, PA
GREATER PITTSBURGH INTL
ILS Rwy 28L

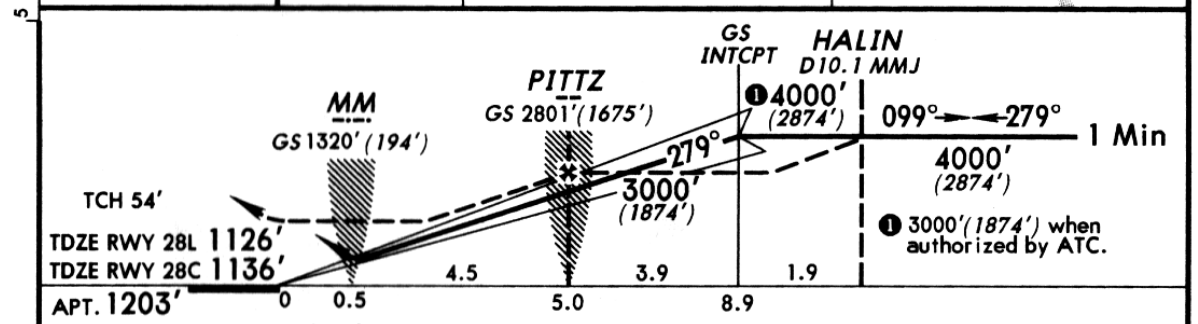
LOC 108.9 IPFS

ATIS Arrival 127.25
PITTSBURGH Approach (R) 123.95
PITTSBURGH Tower Rwys 10L, 28R 128.3
Rwys 10R, 10C, 14, 28L, 28C, 32 119.1
Ground 121.9

3100' MSA MMJ VOR

Apt. Elev 1203'





MISSED APPROACH: Climb to 1800' then climbing LEFT turn to 4000' via 180° heading then direct AGC VOR and hold.

STRAIGHT-IN LANDING RWY 28L	ILS				LOC (GS out)			SIDESTEP LANDING RWY 28C	CIRCLE-TO-LAND	
	DH 1326'(200')			DH 1376'(250')	MDA 1620'(494')			MDA 1620'(484')		MDA
	FULL	TDZ or CL out	RAIL or ALS out	MM out		RAIL out	ALS out			
A	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	RVR 50 or 1	A	1700'(497')-1
B									B	
C					RVR 40 or 3/4	RVR 60 or 1 1/4		1 1/2	C	1700'(497')-1 1/2
D	RVR 20 or 1/2			RVR 40 or 3/4	RVR 50 or 1	1 1/2		2	D	1760'(557')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	484	538	646	753	861
PITTZ to MAP	5.0	4:17	3:20	3:00	2:30	2:09	1:53

AMEND 2

CHANGES: See other side.

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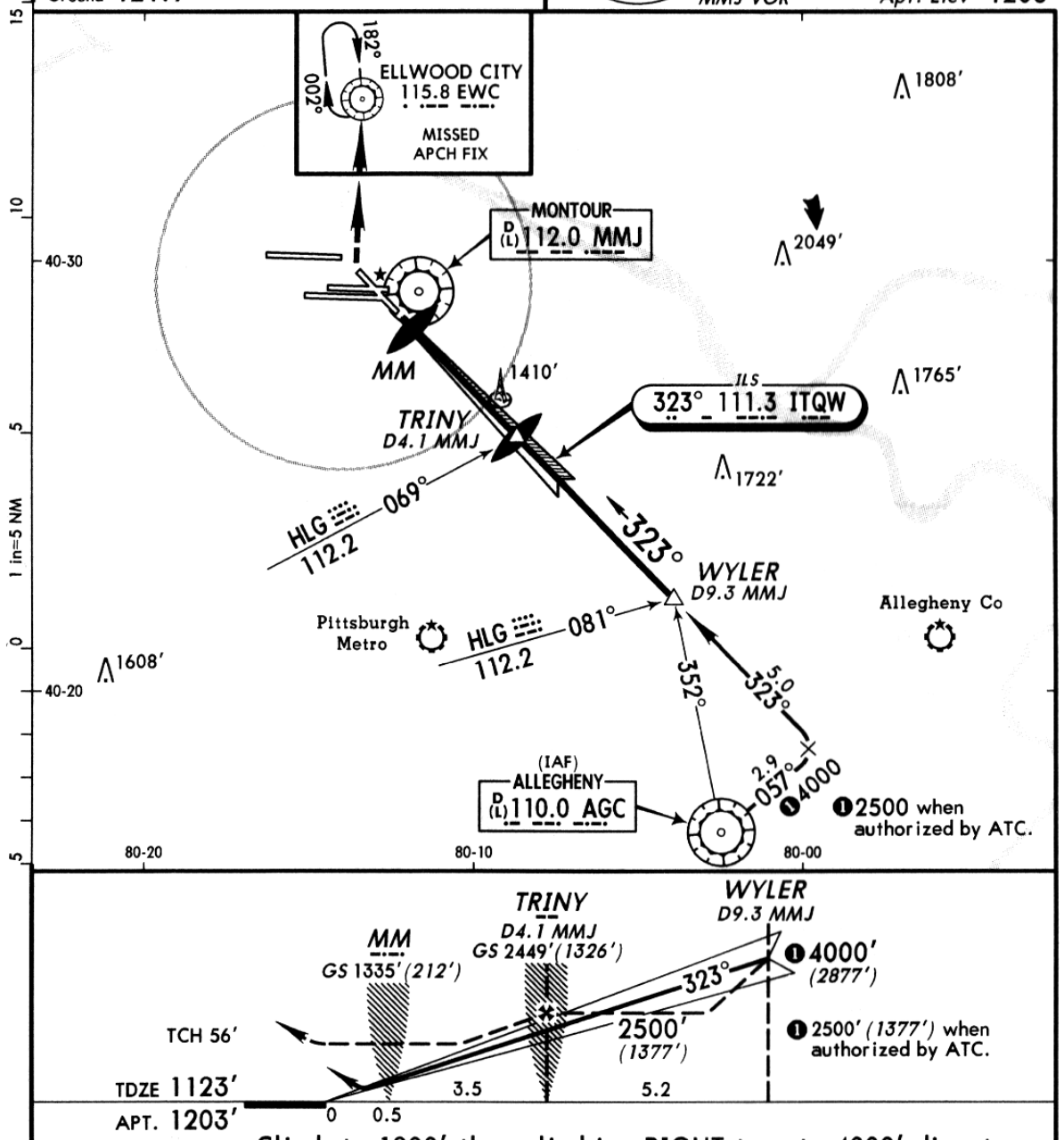
JEPPESEN JAN 12-90 (21-3)

PITTSBURGH, PA
GREATER PITTSBURGH INTL
ILS Rwy 32

ATIS Arrival 127.25
PITTSBURGH Approach (R) 123.95
PITTSBURGH Tower Rwys 10L, 28R 128.3
Rwys 10R, 10C, 14, 28L, 28C, 32 119.1
Ground 121.9

LOC 111.3 ITQW
MSA 3100′
MMJ VOR
Apt. Elev 1203′



MISSED APPROACH: Climb to 1800′ then climbing RIGHT turn to 4000′ direct EWC VOR and hold.

STRAIGHT-IN LANDING RWY 32	ILS			LOC (GS out)		CIRCLE-TO-LAND	
	DA(H) 1323′ (200′)		DA(H) 1373′ (250′)	MDA(H) 1660′ (537′)			
	FULL	ALS out	MM out		ALS out	Max Kts.	MDA(H)
A	3/4		3/4	3/4	1	90	1700′(497′)-1
B						120	
C				1 1/2		140	1700′(497′)-1 1/2
D				1 3/4		165	1760′(557′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	378	486	540	648	756	864
TRINY to MAP 4.0	3:26	2:40	2:24	2:00	1:43	1:30

AMEND 7

CHANGES: See other side.

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JEPPESEN JAN 26-90 (20-9)

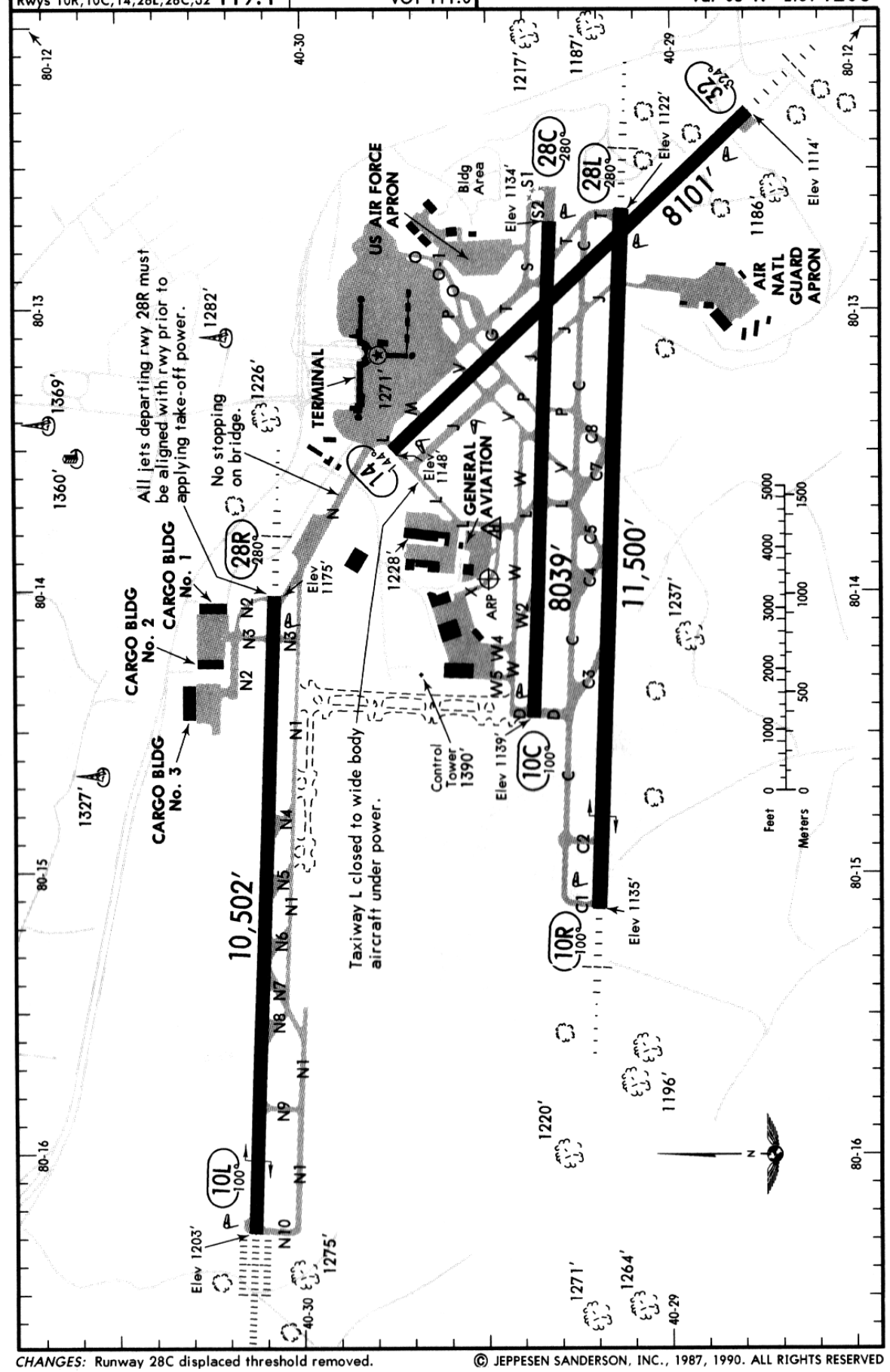
AIRPORT

KPIT PITTSBURGH, PA
GREATER PITTSBURGH INTL

ATIS Departure 111.0
PITTSBURGH Clearance (Cpt) 126.75
Ground 121.9
Tower Rwys 10L, 28R 128.3
Rwys 10R, 10C, 14, 28L, 28C, 32 119.1

PITTSBURGH Departure (R)
300°-059° 124.75
060°-169° 118.7
170°-299° 119.35
VOT 111.0

282.6°/1.8 From MMJ 112.0 N40 29.5 W080 14.0
Var 08°W Elev 1203′



CHANGES: Runway 28C displaced threshold removed.

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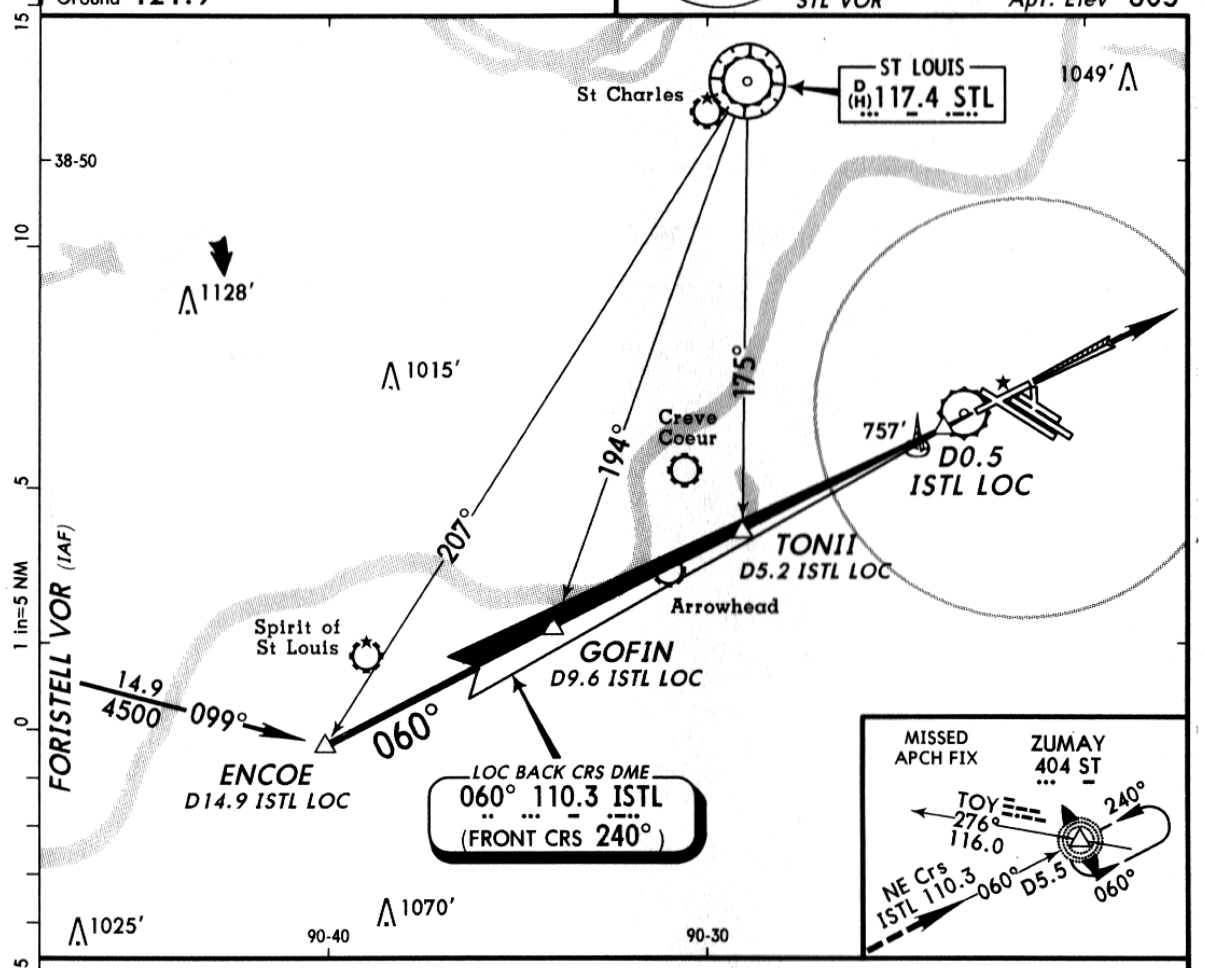
JEPPESEN NOV 4-88 (11-6)

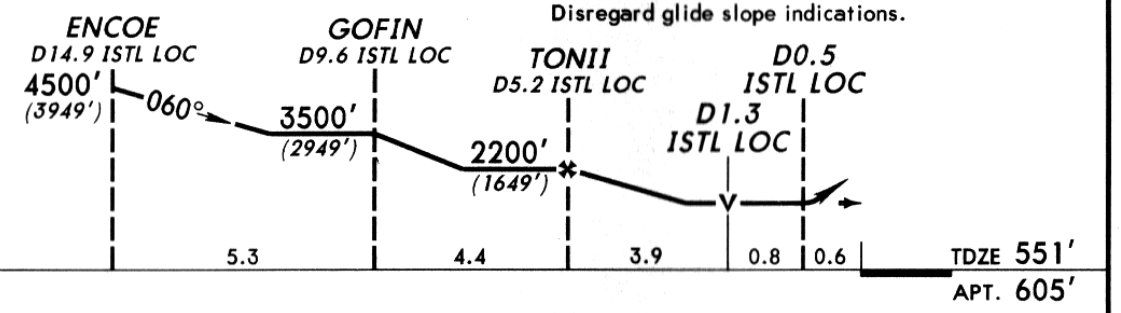
ST LOUIS, MO
LAMBERT-ST LOUIS INTL
LOC (BACK CRS) Rwy 6

ATIS 120.45 119.92 (HI ALT)
ST LOUIS Approach (R) 126.5
ST LOUIS Tower North 120.05 South 118.5
Ground 121.9

LOC 110.3 ISTL
Apt. Elev 605'



Disregard glide slope indications.



MISSED APPROACH: Climb to 3000' direct ZUMAY LOM/D5.5 ISTL LOC and hold.

STRAIGHT-IN LANDING RWY 6 MDA 1020' (469')			CIRCLE-TO-LAND MDA
	RAIL out	ALS out	
A	3/4	1	A 1060' (455') - 1
B			B
C	3/4	1 1/4	C 1060' (455') - 1 1/2
D	1	1 1/2	D 1160' (555') - 2

Gnd speed-Kts	70	90	100	120	140	160
MAP at D0.5 or TONII to MAP 4.7	4:02	3:08	2:49	2:21	2:01	1:46

AMEND 1

CHANGES: See other side.

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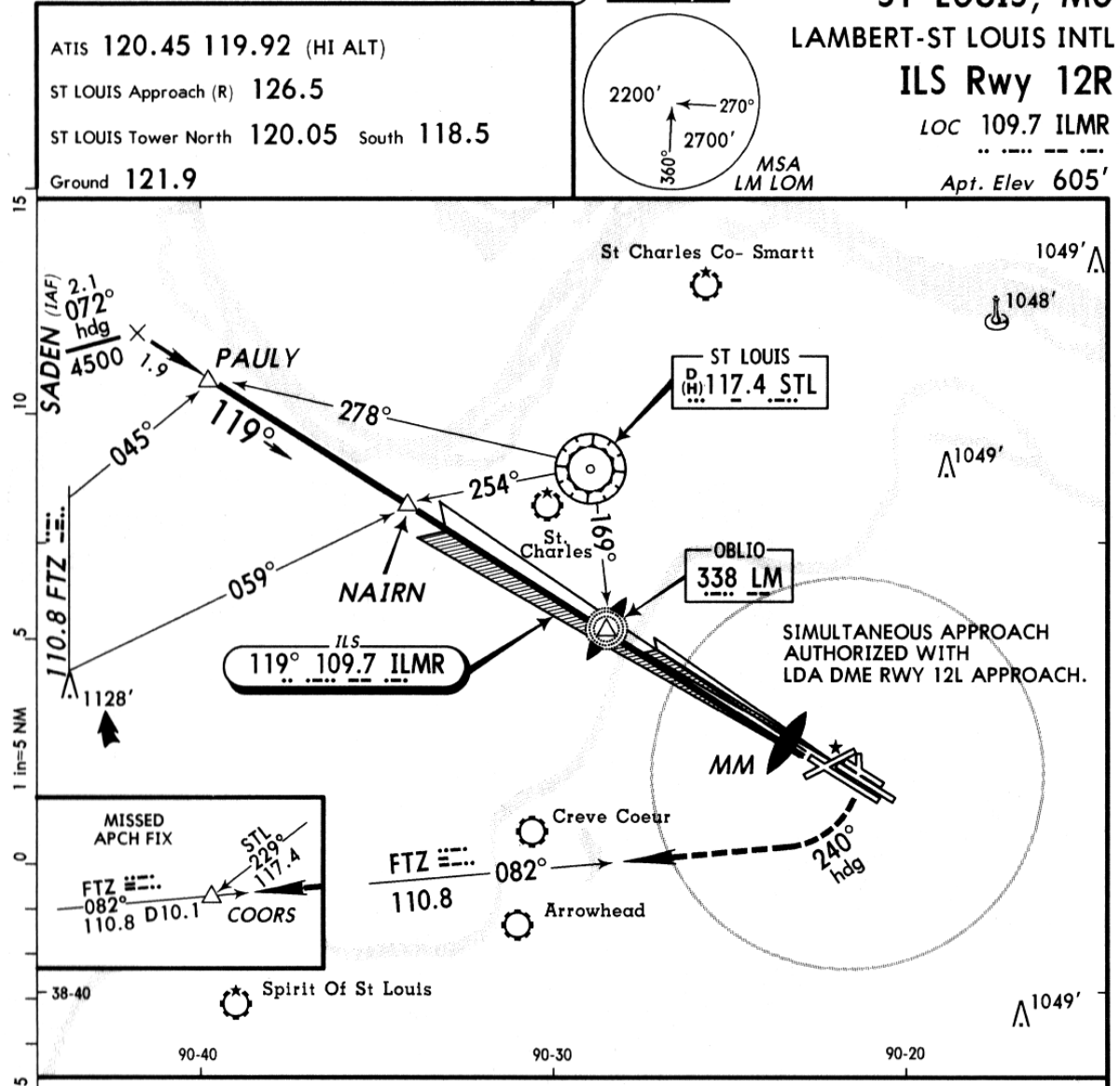
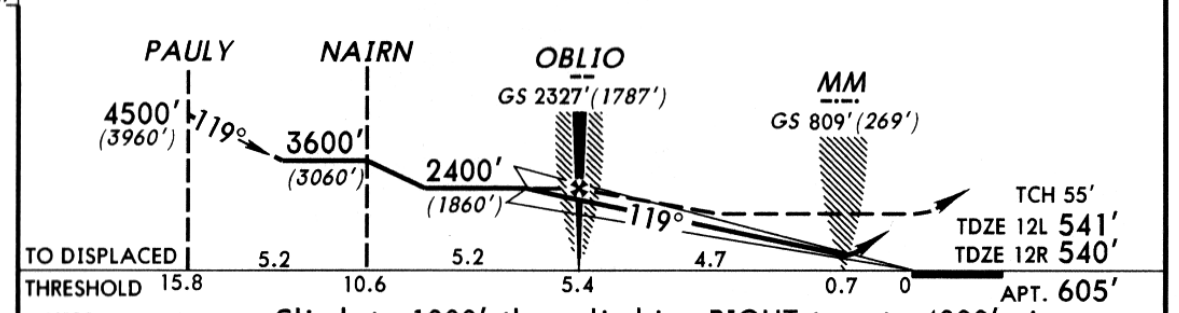
JEPPESEN APR 27-90 (11-2) Eff May 3

ST LOUIS, MO
LAMBERT-ST LOUIS INTL
ILS Rwy 12R

ATIS 120.45 119.92 (HI ALT)
ST LOUIS Approach (R) 126.5
ST LOUIS Tower North 120.05 South 118.5
Ground 121.9

LOC 109.7 ILMR
Apt. Elev 605'





MISSED APPROACH: Climb to 1000' then climbing RIGHT turn to 4000' via heading 240° and inbound on FTZ VOR R-082 to COORS INT.

	ILS DA(H) 790' (250')			STRAIGHT-IN LANDING RWY 12R LOC (GS out) MDA(H) 960' (420')			SIDESTEP LANDING RWY 12L MDA(H) 960' (419')	CIRCLE-TO-LAND	
	FULL	RAIL or ALS out	MM out		MM out	RAIL out	ALS out		Max Kts	MDA(H)
A	RVR 40 or 3/4			RVR 40 or 3/4			RVR 50 or 1	1	90	A B 1060' (455') - 1
B									120	
C				RVR 40 or 3/4		RVR 60 or 1 1/4		1 1/2	140	C 1060' (455') - 1 1/2
D				RVR 40 or 3/4	RVR 50 or 1			2	165	D 1160' (555') - 2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
OBLIO to MAP 5.4		4:38	3:36	3:14	2:42	2:19	2:02

AMEND 20

CHANGES: Coors Int formation.

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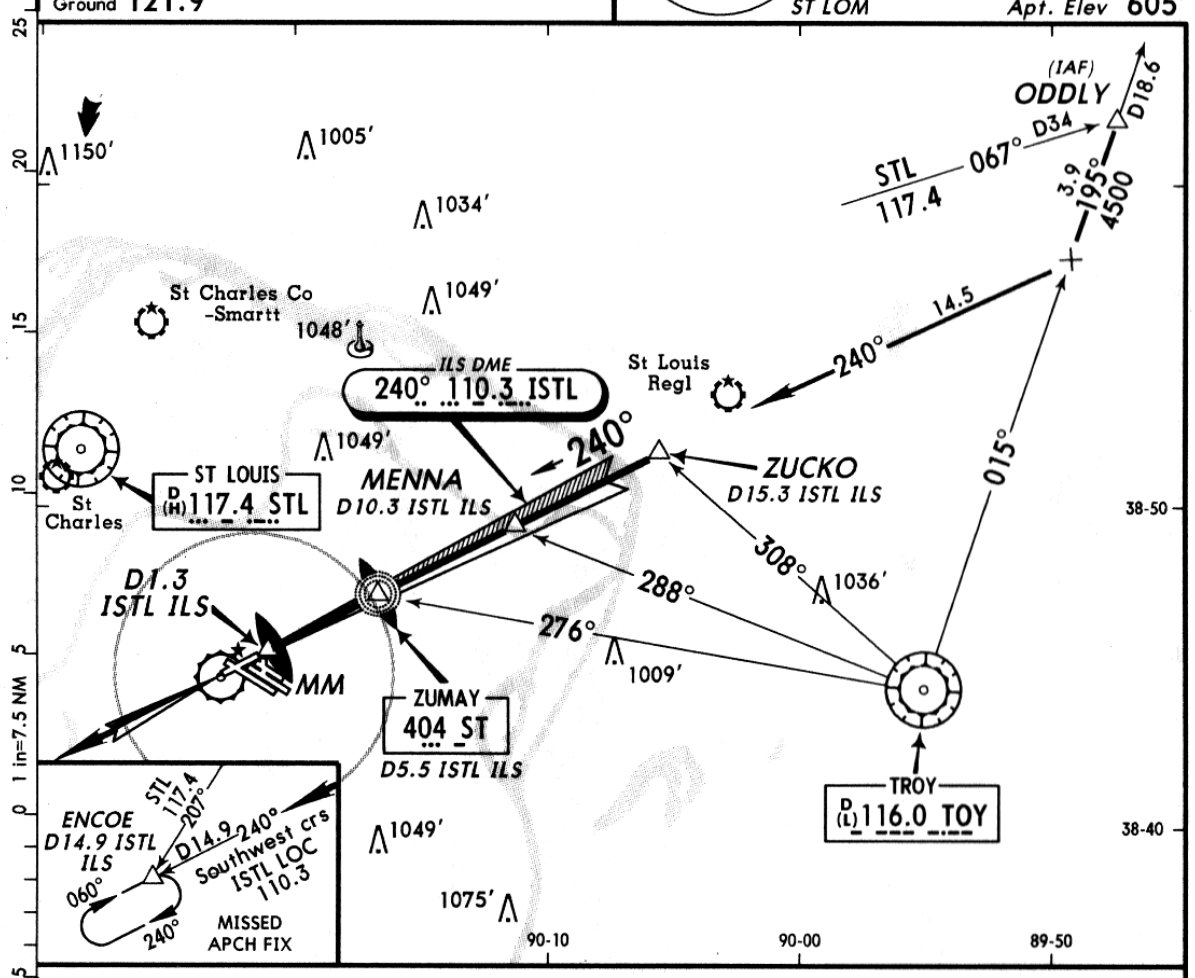
JEPPESEN APR 27-90 (11-3) Eff May 3

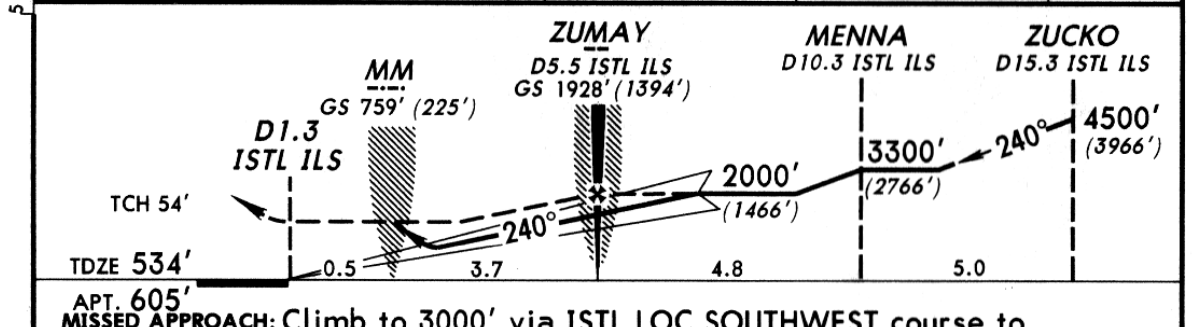
ST LOUIS, MO
LAMBERT-ST LOUIS INTL
ILS Rwy 24

ATIS 120.45 119.92 (HI ALT)
ST LOUIS Approach (R) 126.5
ST LOUIS Tower North 120.05 South 118.5
Ground 121.9

LOC 110.3 ISTL
Apt. Elev 605'

MSA ST LOM: 2200' (090°→270°) 2800'





MISSED APPROACH: Climb to 3000' via ISTL LOC SOUTHWEST course to ENCOE INT/D14.9 ISTL ILS and hold.

STRAIGHT-IN LANDING RWY 24	ILS			LOC (GS out)		CIRCLE-TO-LAND
	DA(H) 784' (250')			MDA(H) 1000' (466')		
	FULL	ALS out	MM out		ALS out	
A	RVR 40 or ¾			RVR 40 or ¾	RVR 50 or 1	NA
B						
C				RVR 60 or 1¼		
D				1½		

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	376	484	538	645	753	860
MAP at D1.3 ISTL ILS or ZUMAY to MAP	4.2	3:36	2:48	2:31	2:06	1:48	1:34

AMEND 42

CHANGES: Procedure.

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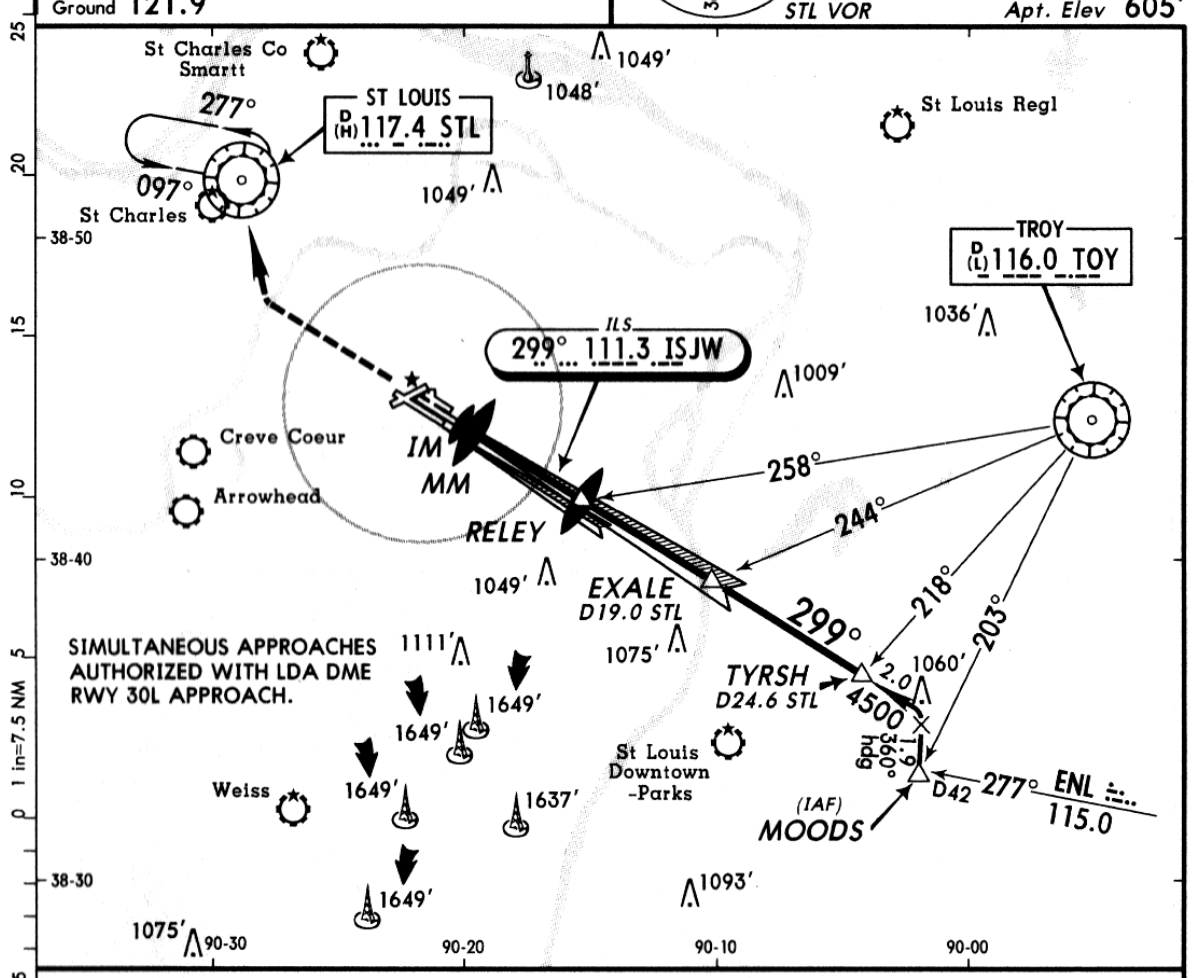
JEPPESEN APR 27-90 (11-1A) Eff May 3

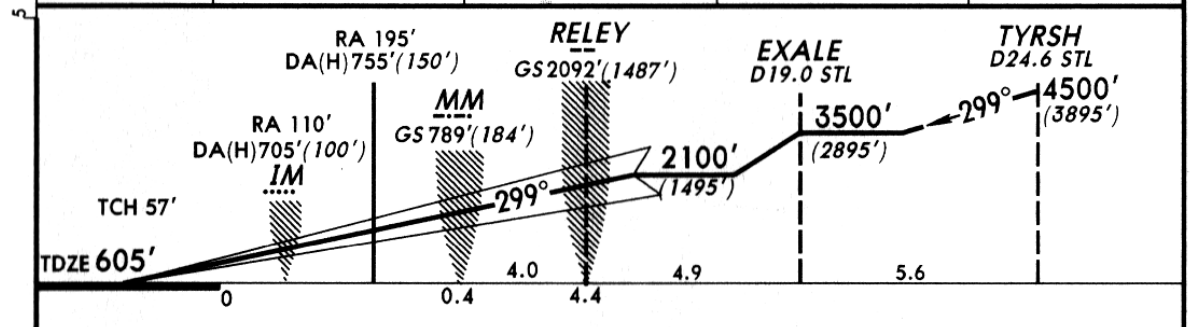
ST LOUIS, MO
LAMBERT-ST LOUIS INTL
ILS Rwy 30R CAT II
Special Aircrew & Acft Certification Required

ATIS 120.45 119.92 (HI ALT)
ST LOUIS Approach (R) 126.5
ST LOUIS Tower North 120.05 South 118.5
Ground 121.9

LOC 111.3 ISJW
Apt. Elev 605'

MSA STL VOR: 2200' (270°) 2800' (360°)





MISSED APPROACH: Climb to 3000' then direct STL VOR and hold.

STRAIGHT-IN LANDING RWY 30R CAT II ILS	RA 110' DA(H) 705' (100')	RA 195' DA(H) 755' (150')
	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	484	538	646	753	861

AMEND 6

CHANGES: MSA, missed approach.

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JEPPESEN MAY 18-90 (10-9)

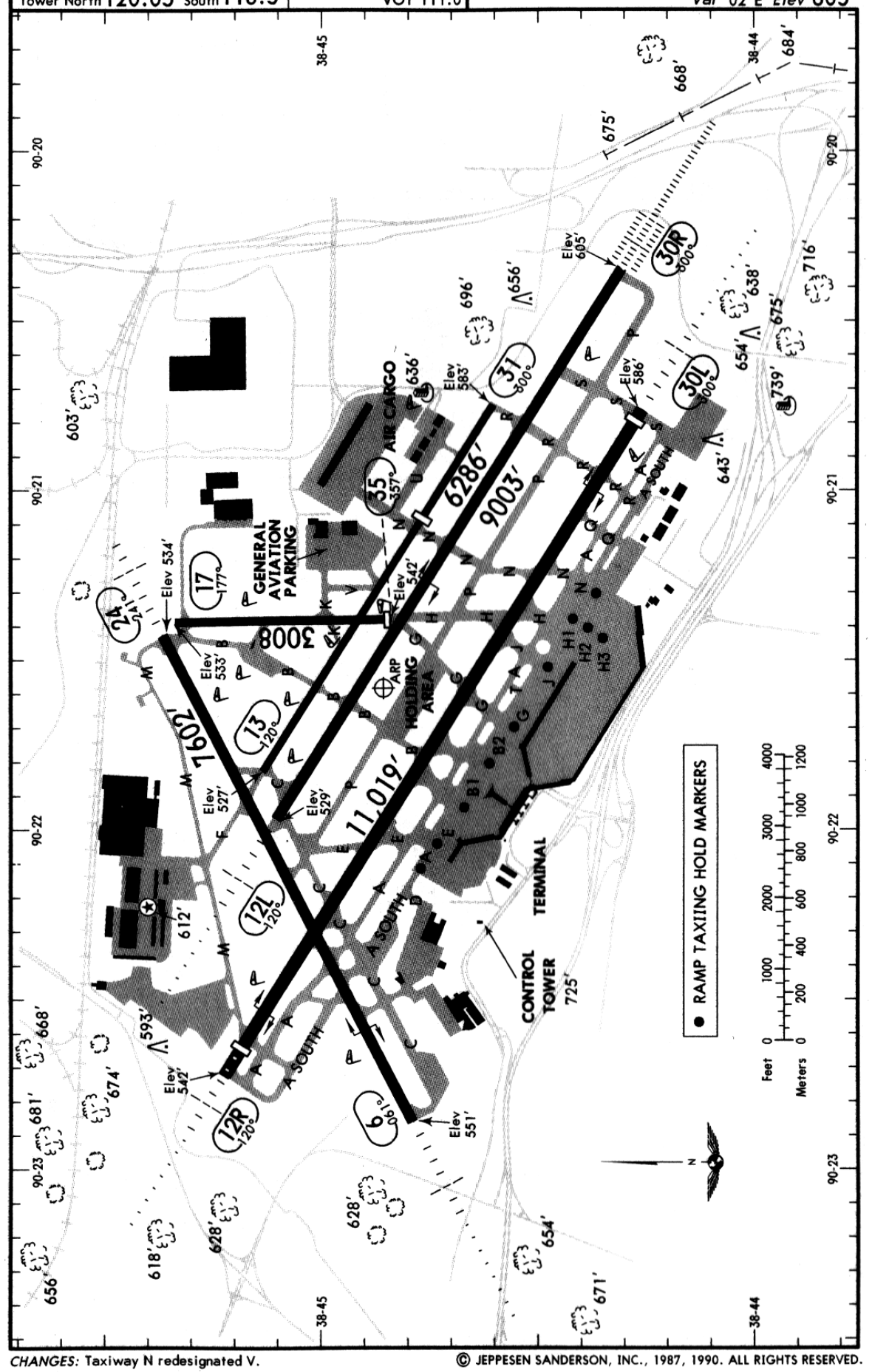
AIRPORT

ATIS 120.45 119.92 (HI ALT)
ST LOUIS Clearance (Cpt) 119.5
Ground 121.9
Tower North 120.05 South 118.5

ST LOUIS Departure (R)
N/E 119.15
S/W 118.95
VOT 111.0

KSTL ST LOUIS, MO
LAMBERT-ST LOUIS INTL

134.7°/8.9 From STL 117.4 N38 44.9 W090 21.6
Var 02°E Elev 605'



CHANGES: Taxiway N redesignated V.

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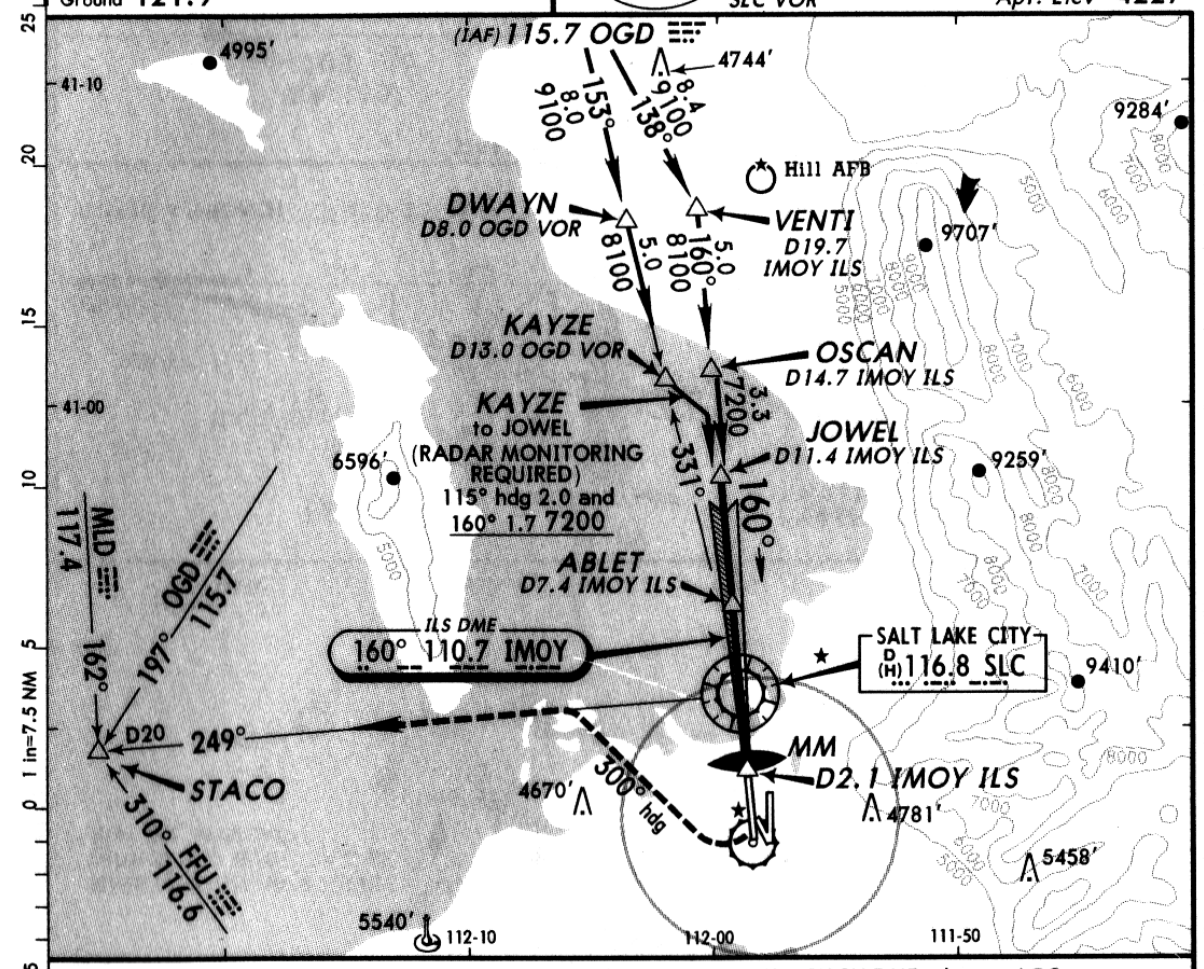
JEPPESEN MAY 25-90 (11-2)

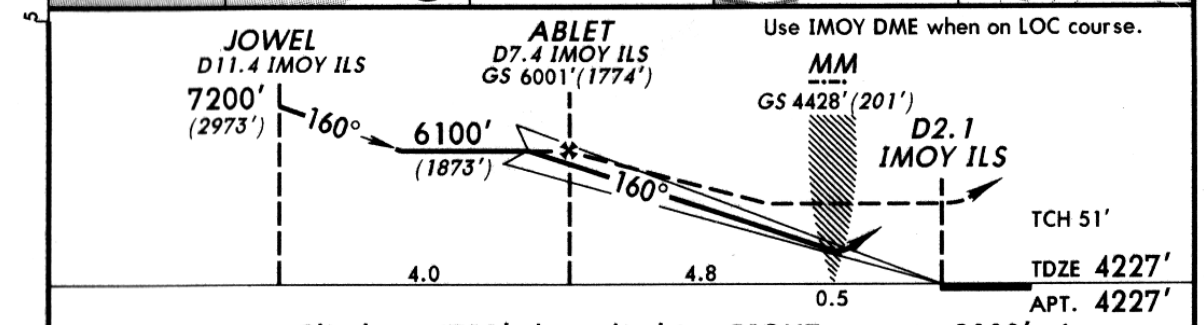
ATIS 124.75
SALT LAKE CITY Approach (R) 124.3
SALT LAKE CITY Tower
Rwy 16L-34R 118.3
Rwy 16R-34L 119.05
Ground 121.9

SALT LAKE CITY, UTAH
SALT LAKE CITY INTL
ILS DME Rwy 16R

LOC 110.7 IMOY
Apt. Elev 4227'

MSA SLC VOR
140° 10,800' 230°
7700' 050° 12,500





MISSED APPROACH: Climb to 4700' then climbing RIGHT turn to 9000' via 300° heading and outbound on SLC VOR R-249 to STACO INT/D20.0 FIX.

STRAIGHT-IN LANDING RWY 16R

	ILS DA(H) 4427' (200') FULL	ILS DA(H) 4477'(250') TDZ or CL out	ILS DA(H) 4477'(250') RAIL or ALS out	ILS DA(H) 4477'(250') MM out	LOC (GS out) MDA(H) 4560'(333')	MM out	RAIL out	ALS out
A	RVR 18 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2		RVR 40 or 3/4	RVR 50 or 1
B								
C								
D	RVR 20 or 1/2			RVR 40 or 3/4	RVR 40 or 3/4	RVR 50 or 1		

CIRCLE-TO-LAND
NA East of Rwy 16L-34R

Max Kts	MDA(H)
90	4640'(413')-1
120	4680'(453')-1
140	4680'(453')-1 1/2
165	4780'(553')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	539	647	755	862
MAP at D2.1 IMOY ILS							

AMND 4

CHANGES: Tower frequencies.

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JEPPESEN MAY 25-90 (11-1A)

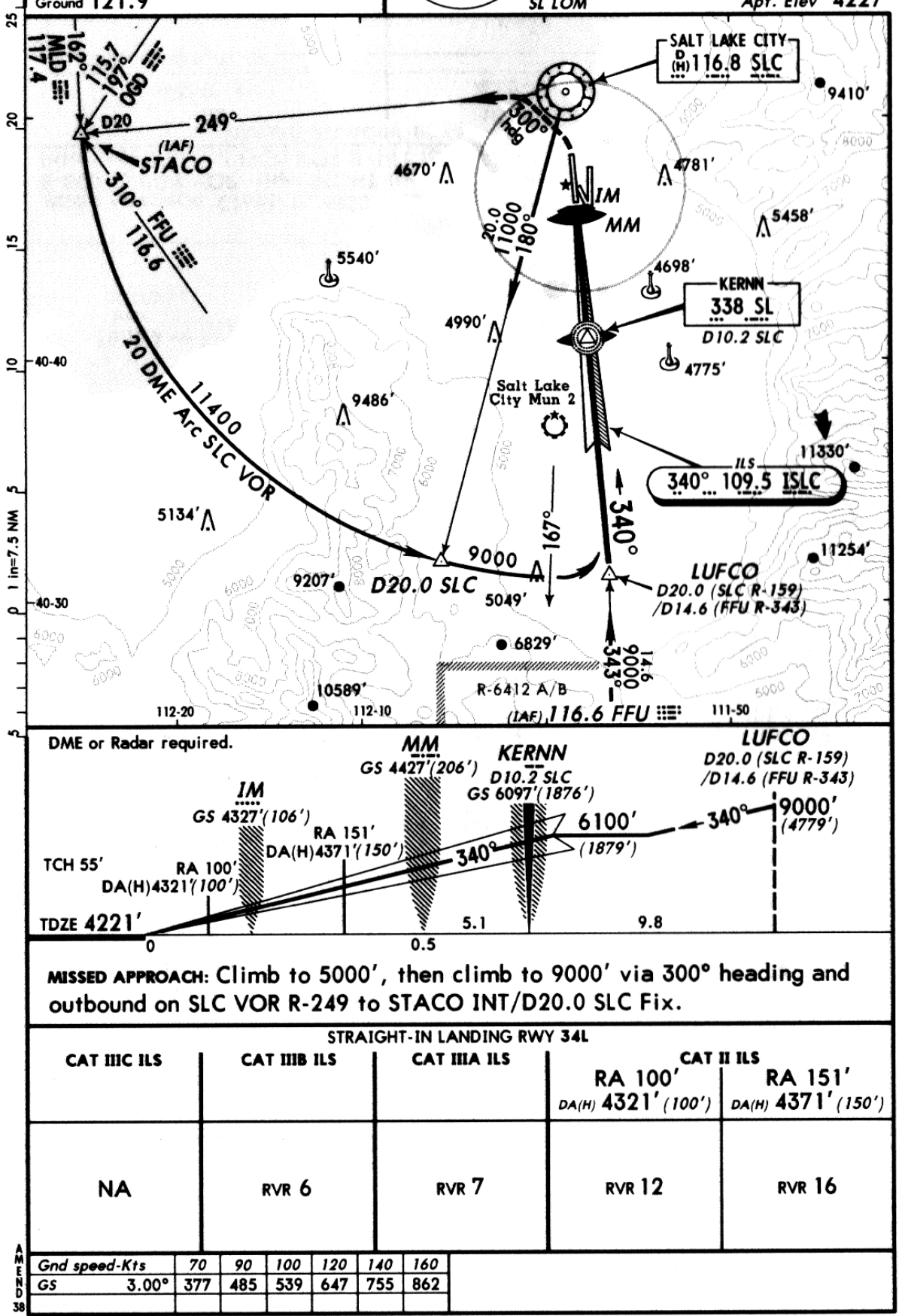
SALT LAKE CITY, UTAH
SALT LAKE CITY INTL
ILS Rwy 34L CAT II & III

Special Aircrew & Acft Certification Required

LOC 109.5 ISLC

Apt. Elev 4227'

ATIS 124.75
SALT LAKE CITY Approach (R) 124.3
SALT LAKE CITY Tower
Rwy 16L-34R 118.3
Rwy 16R-34L 119.05
Ground 121.9



MISSED APPROACH: Climb to 5000', then climb to 9000' via 300° heading and outbound on SLC VOR R-249 to STACO INT/D20.0 SLC Fix.

STRAIGHT-IN LANDING RWY 34L

CAT IIIC ILS	CAT IIIB ILS	CAT IIIA ILS	CAT II ILS RA 100' DA(H) 4321' (100')	CAT II ILS RA 151' DA(H) 4371' (150')
NA	RVR 6	RVR 7	RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 38

CHANGES: Tower frequencies.

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JEPPESEN MAY 25-90 (10-9)

AIRPORT

KSLC SALT LAKE CITY, UTAH
SALT LAKE CITY INTL

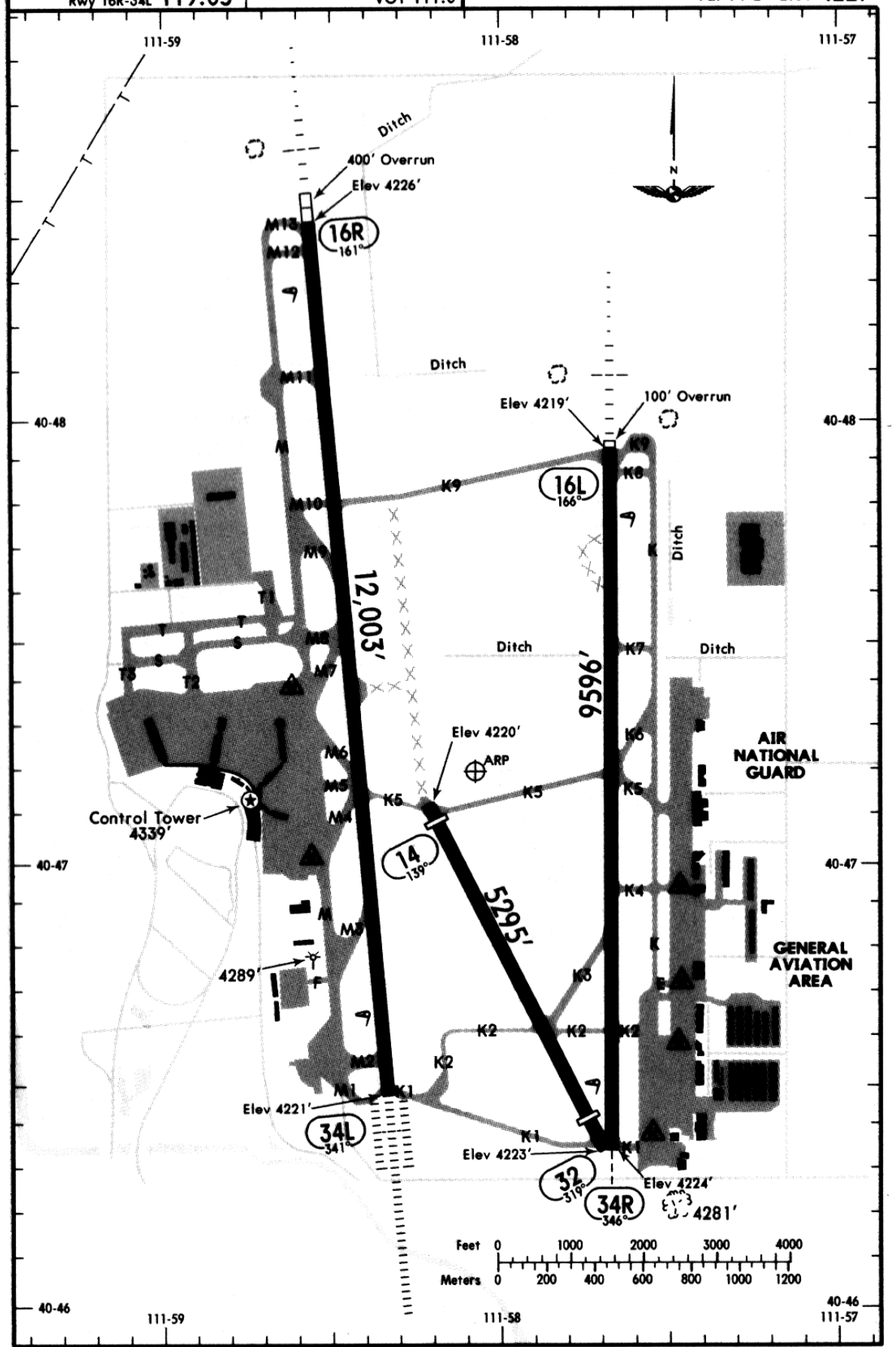
155.1°/3.9 From SLC 116.8 N40 47.2 W111 58.1

Var 14°E Elev 4227'

ATIS 124.75
SALT LAKE CITY Clearance (Cpt) 127.3
Ground 121.9
Tower Rwy 16L-34R 118.3
Rwy 16R-34L 119.05

SALT LAKE CITY Departure (R) 124.3

VOT 111.0



CHANGES: Tower frequencies.

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JEPPESEN DEC 16-88 (11-1)

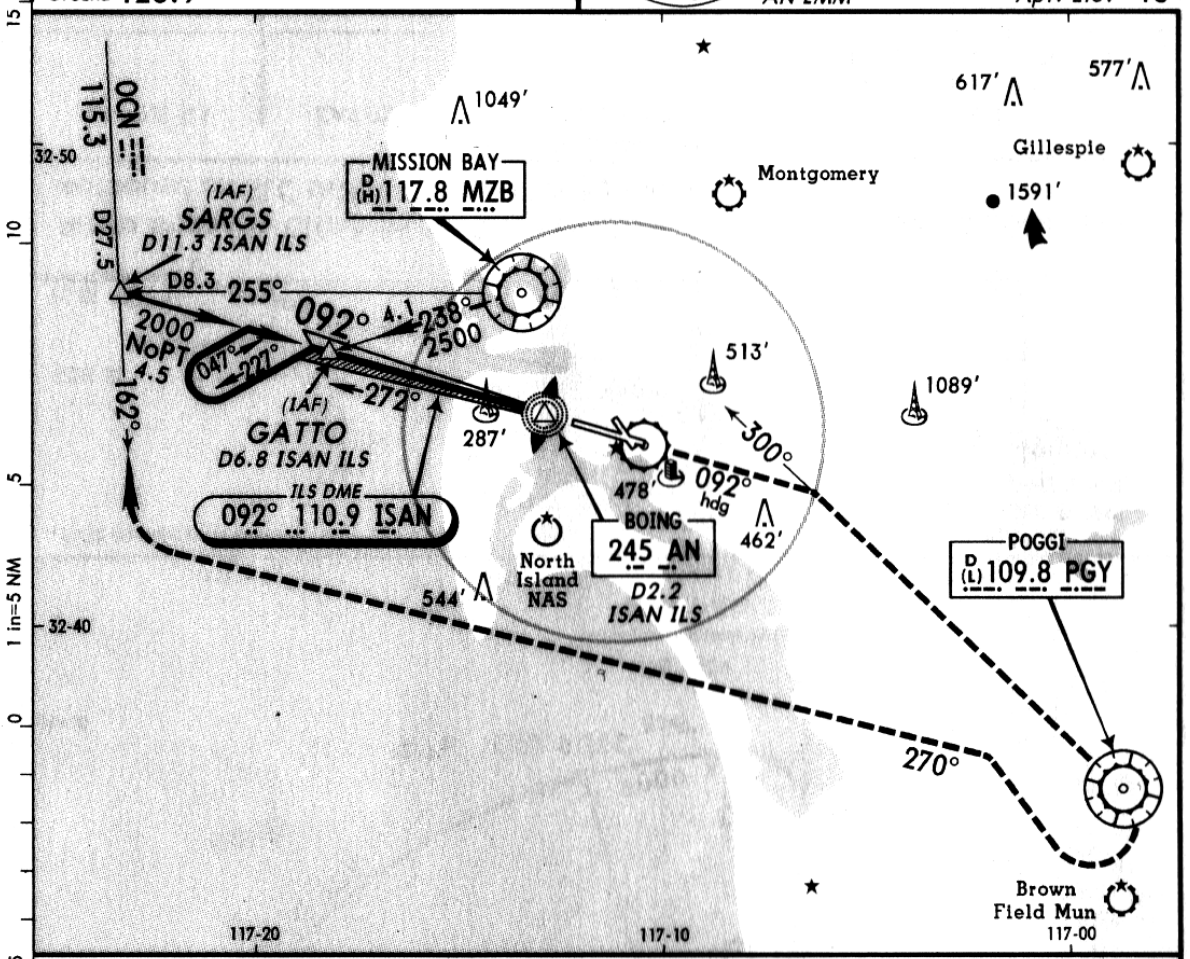
SAN DIEGO, CALIF
SAN DIEGO INTL-LINDBERGH
ILS Rwy 9

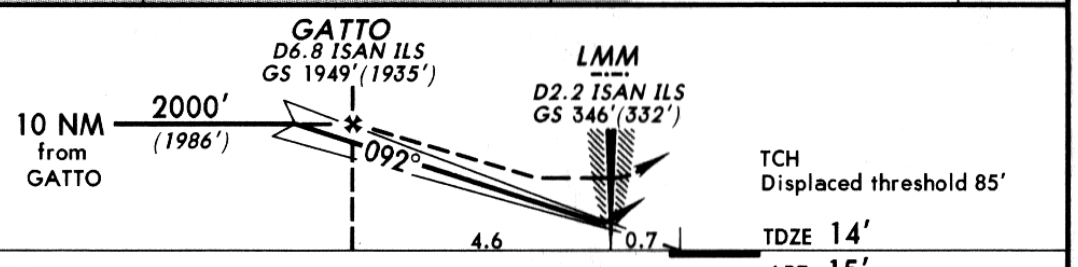
LOC 110.9 ISAN

Apt. Elev 15′

ATIS 134.8
SAN DIEGO Approach (R) 127.3
LINDBERGH Tower 118.3
Ground 123.9

MSA
AN LMM
140° 4700′ 230°
2100′ 5200′
340°





MISSED APPROACH: Climb to 4000′ via heading 092° and inbound on PGY VOR R-300 to PGY VOR, then RIGHT turn outbound via PGY VOR R-270 to intercept inbound OCN VOR R-162 to SARGS INT.

STRAIGHT-IN LANDING RWY 9	ILS			LOC (GS out)	CIRCLE-TO-LAND
	DH 350′ (336′)			MDA 540′ (526′)	MDA
	FULL	RAIL or ALS out	MM out		
A	RVR 50 or 1			RVR 50 or 1	A 800′(785′)-1
B					B 800′(785′)-1 1/4
C				1 1/2	C 800′(785′)-2 1/4
D				1 3/4	D 820′(805′)-2 1/2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.22°	404	520	577	693	808	924
MAP at D2.2 ISAN or GATTO to MAP 4.6	3:57	3:04	2:46	2:18	1:58	1:44

Air carrier landing visibility reduction for local conditions NA.

AMEND 0

CHANGES: See other side.

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SAN DIEGO, CALIF KSAN
SAN DIEGO INTL-LINDBERGH

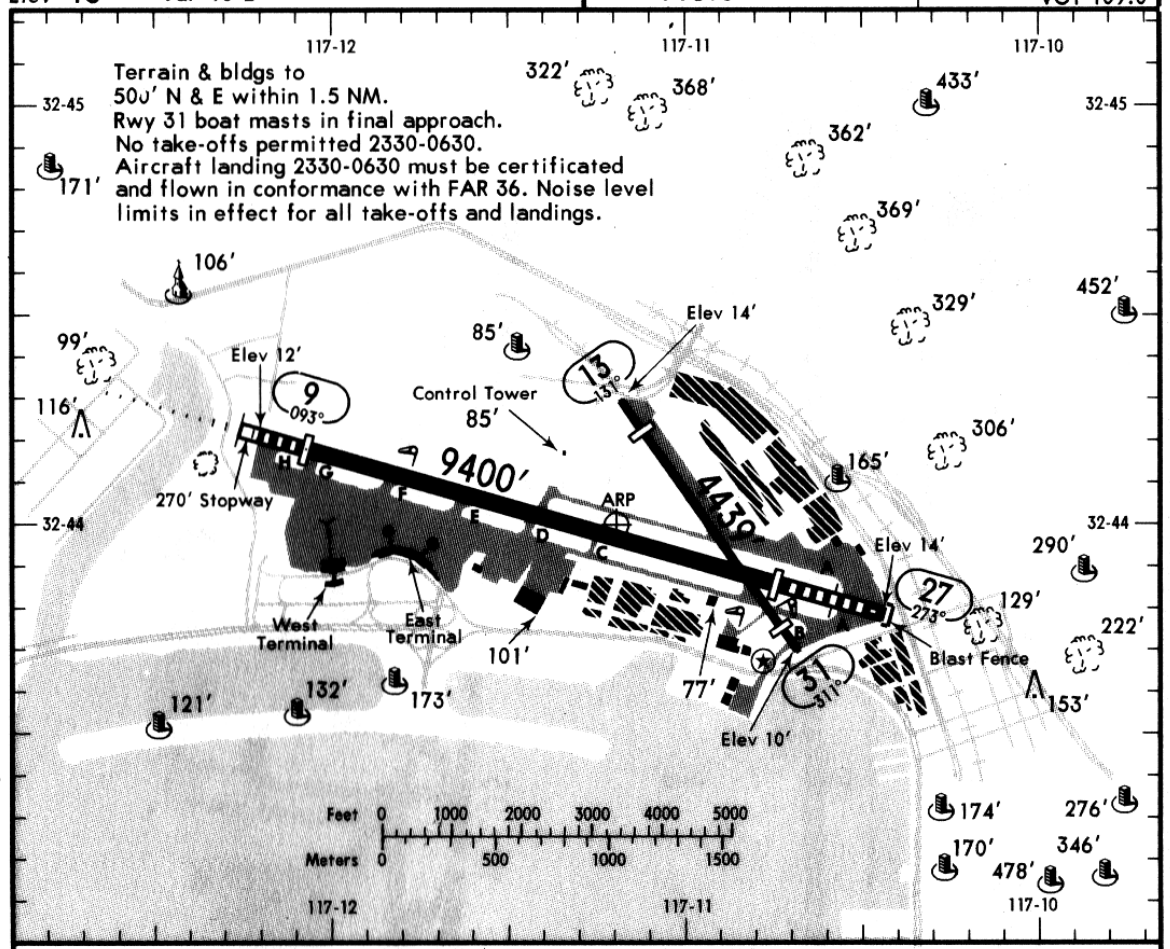
JEPPESEN (11-1) DEC 16-88

N32 44.0 W117 11.2 131.7°/3.5 From MZB 117.8

Elev 15′ Var 13°E

ATIS 134.8
LINDBERGH Clearance (Cpt) 125.9
Ground 123.9
Tower 118.3

SAN DIEGO Departure (R)
V-23 125.3
Eastbound 124.35
Westbound 128.0
VOT 109.0



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS: LANDING BEYOND Threshold	LANDING BEYOND Glide Slope	TAKE-OFF	WIDTH
9	HIRL CL MALSR TDZ grooved RVR	8697′	7200′		200′
27	HIRL CL MALS TDZ ❶ PAPI-L grooved RVR	7590′			
13 ❷ 31	MIRL	3890′ / 4039′			75′

❶ Non-std, angle 3.5°.
❷ Single wheel aircraft-Max GWT 30,000 lbs.

TAKE-OFF & IFR DEPARTURE PROCEDURE

	Rwy 27				Rwy 31			Rwy 13		
	With Mim climb of 320′/NM to 500′			Other	With Mim climb of 320′/NM to 500′		Other	With Mim climb of 480′/NM to 1400′		Other
	CL & RCLM	Forward Vis Ref	STD		Forward Vis Ref	STD		Forward Vis Ref	STD	
1 & 2 Eng	TDZ RVR 6	RVR 16 or 1/4	RVR 50 or 1	400-1	1/4	1	400-1	1/4	1	600-1
3 & 4 Eng	Rollout RVR 6		RVR 24 or 1/2			1/2			1/2	

TAKE-OFF & IFR DEPARTURE PROCEDURE

	Rwy 9		FOR FILING AS ALTERNATE		
	With Mim climb of 440′/NM to 1400′	Other	LOC Rwy 27	NDB Rwy 27	Other
1 & 2 Eng	500-1	1100-2	A 800-2	1200-2	800-2
3 & 4 Eng			B 900-2		
			C 900-2 1/2	1200-3	900-2 1/2
			D		

IFR DEPARTURE PROCEDURE: Comply with SID or radar vectors, or:
All departures climb direct MZB VOR then via assigned airway.

AMEND 3

CHANGES: Rwy 27 lighting, RVR & take-off minimums.

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JEPPESEN JUL 21-89 Eff Jul 27 (11-2)

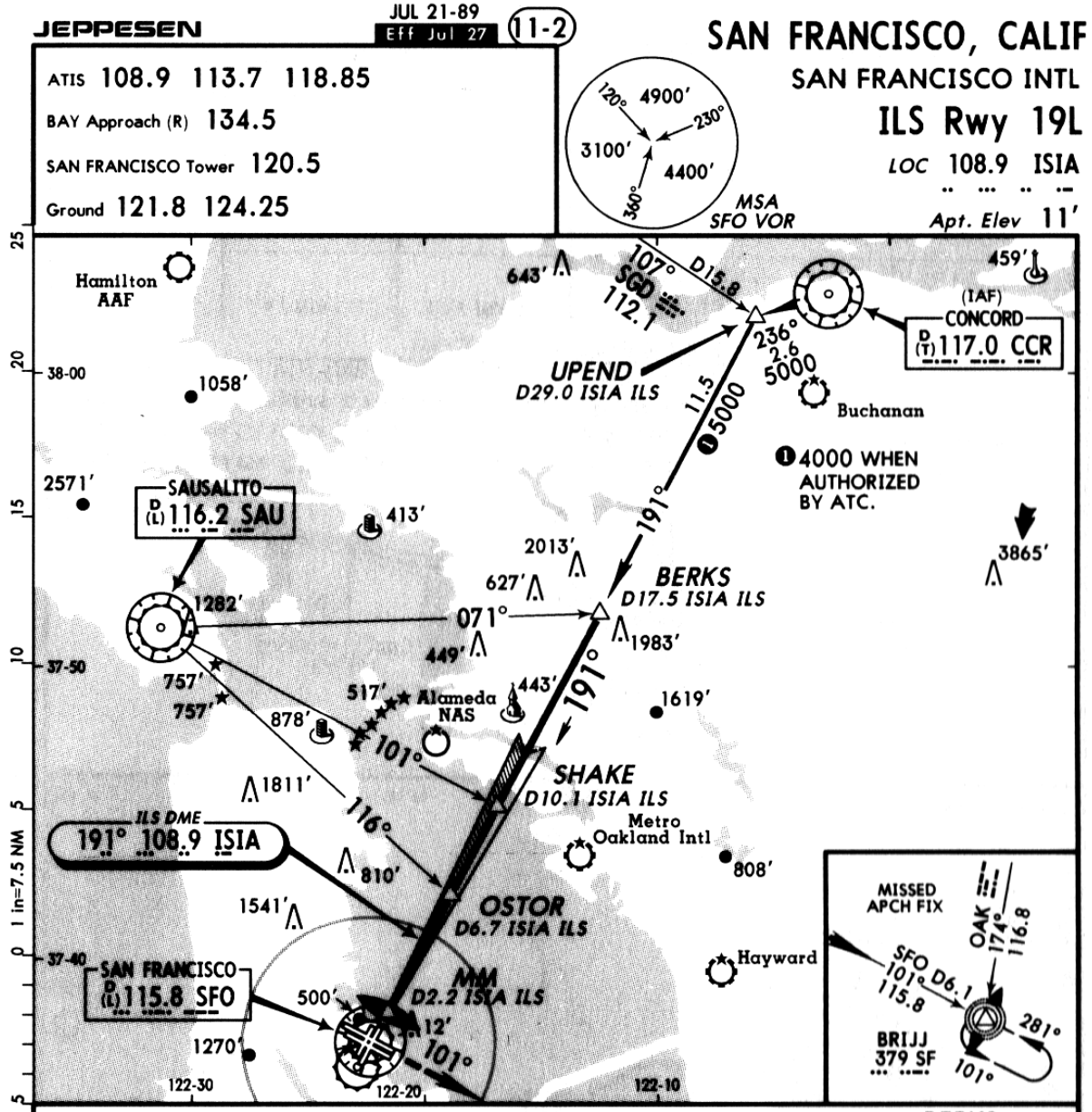
SAN FRANCISCO, CALIF

SAN FRANCISCO INTL

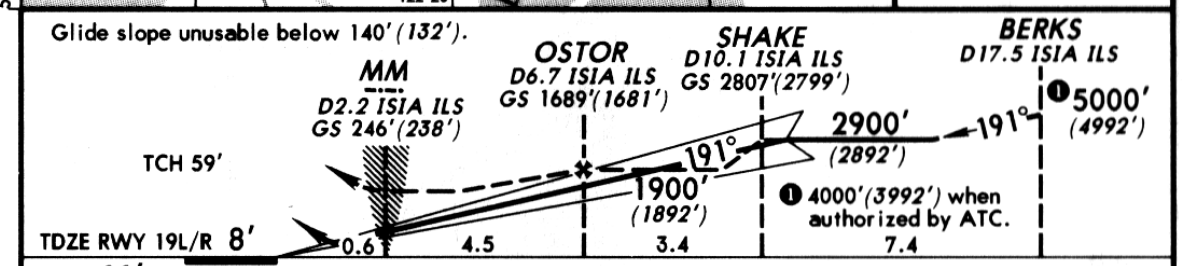
ILS Rwy 19L

ATIS 108.9 113.7 118.85
BAY Approach (R) 134.5
SAN FRANCISCO Tower 120.5
Ground 121.8 124.25

LOC 108.9 ISIA
Apt. Elev 11'



Glide slope unusable below 140' (132').



APT. 11'

MISSED APPROACH: Climb to 420' then climbing LEFT turn to 2000' outbound via SFO VOR R-101 to BRIJJ INT/SF LOM and hold.

	STRAIGHT-IN LANDING RWY 19L ILS DH 208' (200') FULL | ALS out	ILS DH 258' (250') MM out	LOC (GS out) MDA 340' (332')	SIDESTEP LANDING RWY 19R MDA 340' (332')	CIRCLE-TO-LAND MDA
A	RVR 40 or ¾	RVR 40 or ¾	RVR 50 or 1	RVR 50 or 1	740' (729') - 1
B					940' (929') - 1¼
C				1½	1020' (1009') - 3
D				2	1260' (1249') - 3

Gnd speed-Kts	70	90	100	120	140	160
GS 2.95°	371	476	529	635	741	847
MAP at D2.2 ISIA or OSTOR to MAP 4.5	3:51	3:00	2:42	2:15	1:56	1:41

AMEND 18

CHANGES: MSA, procedure altitudes, circling MDAs.

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JEPPESEN JUL 21-89 Eff Jul 27 (11-3)

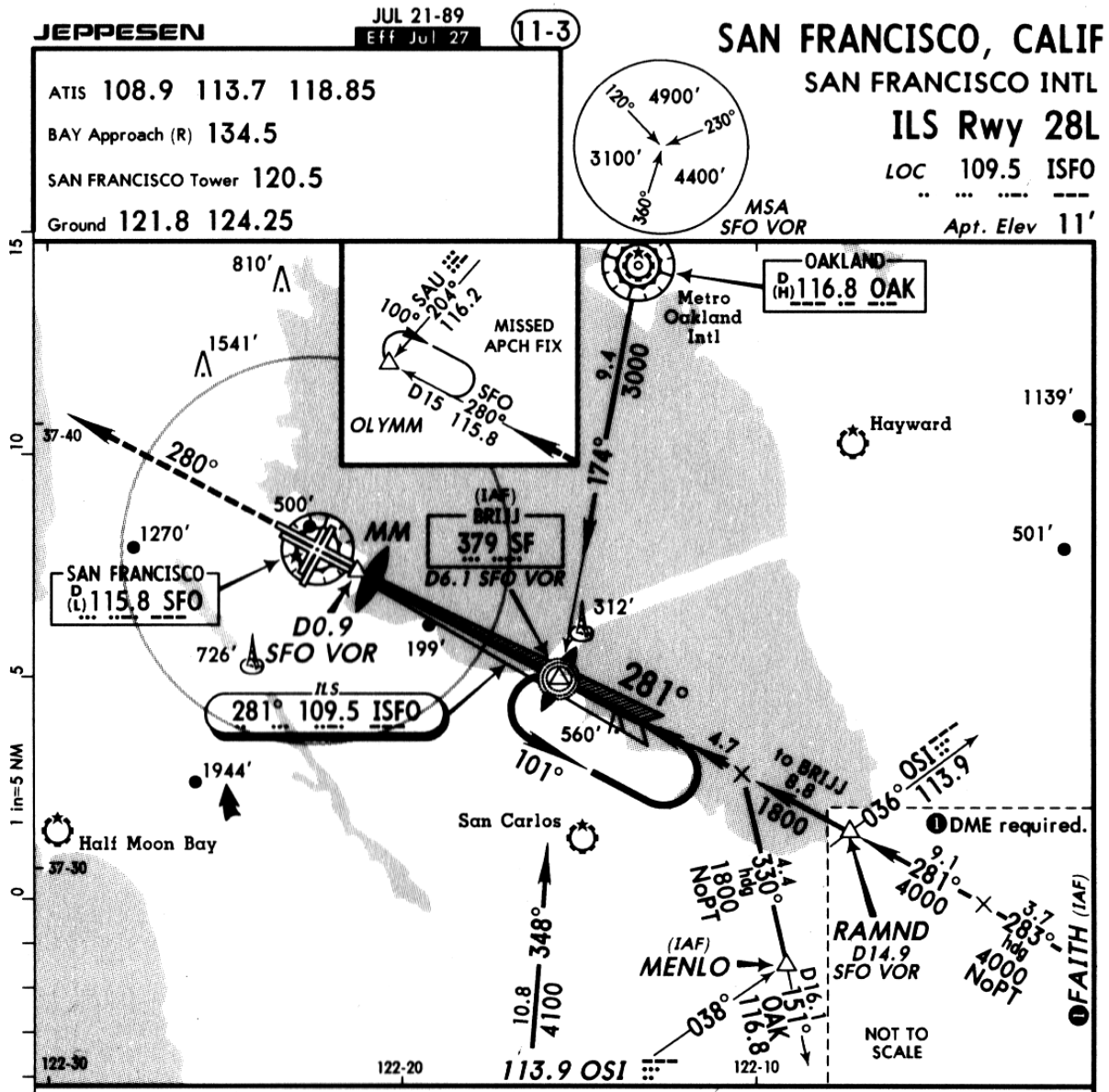
SAN FRANCISCO, CALIF

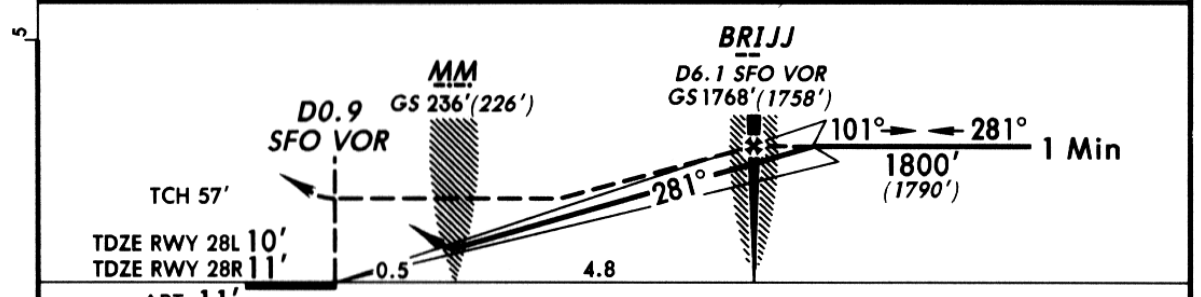
SAN FRANCISCO INTL

ILS Rwy 28L

ATIS 108.9 113.7 118.85
BAY Approach (R) 134.5
SAN FRANCISCO Tower 120.5
Ground 121.8 124.25

LOC 109.5 ISFO
Apt. Elev 11'





APT. 11'

MISSED APPROACH: Climb direct SFO VOR, continue climb to 3000' outbound via SFO VOR R-280 to OLYMM INT/D15.0 SFO VOR and hold.

	STRAIGHT-IN LANDING RWY 28L ILS DH 210' (200') FULL	ILS RAIL or ALS out	ILS DH 260' (250') MM out	LOC (GS out) MDA 460' (450')	LOC RAIL out	LOC ALS out	SIDESTEP LANDING RWY 28R MDA 460' (449')	SIDESTEP ALS out	CIRCLE-TO-LAND MDA
A	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	RVR 50 or 1		740' (729') - 1
B									940' (929') - 1¼
C				RVR 40 or ¾	RVR 60 or 1¼		RVR 50 or 1	1½	1020' (1009') - 3
D			RVR 40 or ¾	RVR 50 or 1	1½		1½	2	1260' (1249') - 3

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	378	486	540	647	755	863
MAP at D0.9 SFO VOR or BRIJJ to MAP 5.3	4:33	3:32	3:11	2:39	2:16	1:59

AMEND 18

CHANGES: See other side.

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JEPPESEN DEC 15-89 (11-1A)

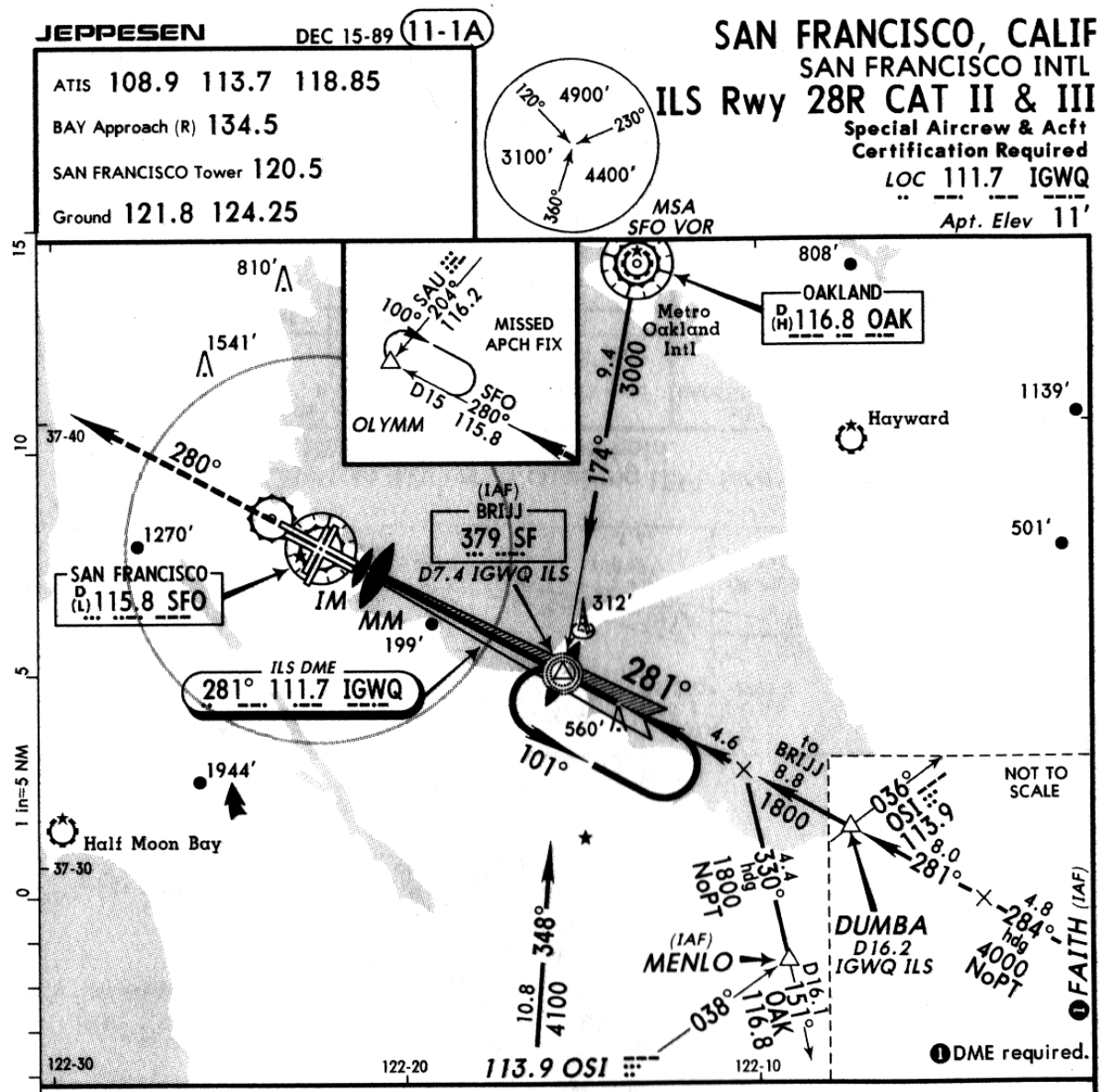
SAN FRANCISCO, CALIF
SAN FRANCISCO INTL
ILS Rwy 28R CAT II & III

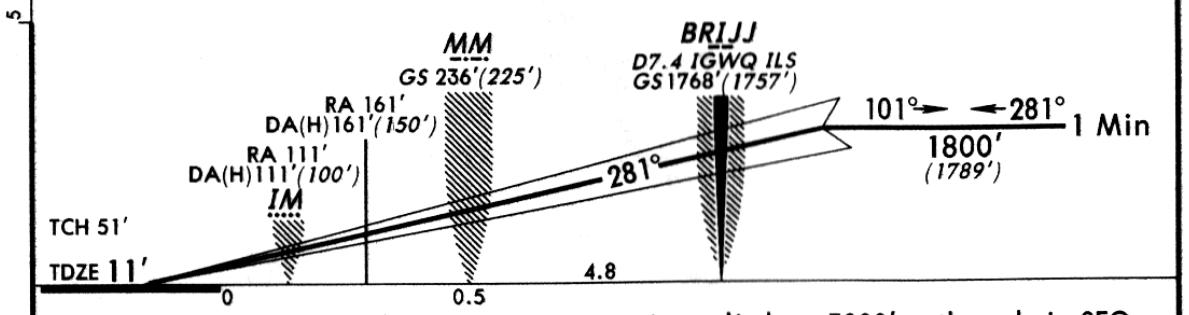
Special Aircrew & Acft Certification Required

LOC 111.7 IGWQ

Apt. Elev 11'

ATIS 108.9 113.7 118.85
BAY Approach (R) 134.5
SAN FRANCISCO Tower 120.5
Ground 121.8 124.25





MISSED APPROACH: Climb direct SFO VOR, continue climb to 3000' outbound via SFO VOR R-280 to OLYMM INT/D15.0 SFO VOR and hold. Obstructions in the missed approach area require a rate of climb of at least 400 feet per minute/100 kt; 600 fpm/150 kt; 800 fpm/200 kt; no wind conditions.

STRAIGHT-IN LANDING RWY **28R**

CAT IIIC ILS	CAT IIIB ILS	CAT IIIA ILS	CAT II ILS RA 111' DA(H) 111'(100')	CAT II ILS RA 161' DA(H) 161'(150')
NA	RVR 6	RVR 7	RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 9
CHANGES: TCH.

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SAN FRANCISCO, CALIF

SAN FRANCISCO INTL

SFO 115.8- On Airport N37 37.1 W122 22.4

Var 16°E *Elev* 11′

JEPPESEN

ATIS Departure 135.45	Bay Departure (R)
SAN FRANCISCO Clearance (Cpt) 118.2	NW-E 120.9
Ground 121.8 124.25	SE-W 135.1
Tower 120.5	(Limited) VOT 111.0

747-400s are restricted from using taxiway C west of taxiway Q.

747-400s shall taxi at a speed of less than 10 mph on all non-restricted taxiways on the terminal side of the intersecting rwys. Movement speed of not more than 5 mph is required when two 747-400s pass or overtake each other on parallel taxiways A and B. 747-400s are restricted from using taxiway E to or from taxiway B.

The first 600′ of rwy 1R not available for holding purposes for take-off. All aircraft when cleared from twy B for taxi into hold position for take-off are to taxi with minimum power only, directly to the "take-off power point" designated by marked signs. Total rwy length available is 8901′ for take-off.

CHANGES: Airport notes.

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JEPPESEN FEB 16-90 (21-1A)

SEATTLE, WASH
-TACOMA INTL
ILS Rwy 16R CAT II

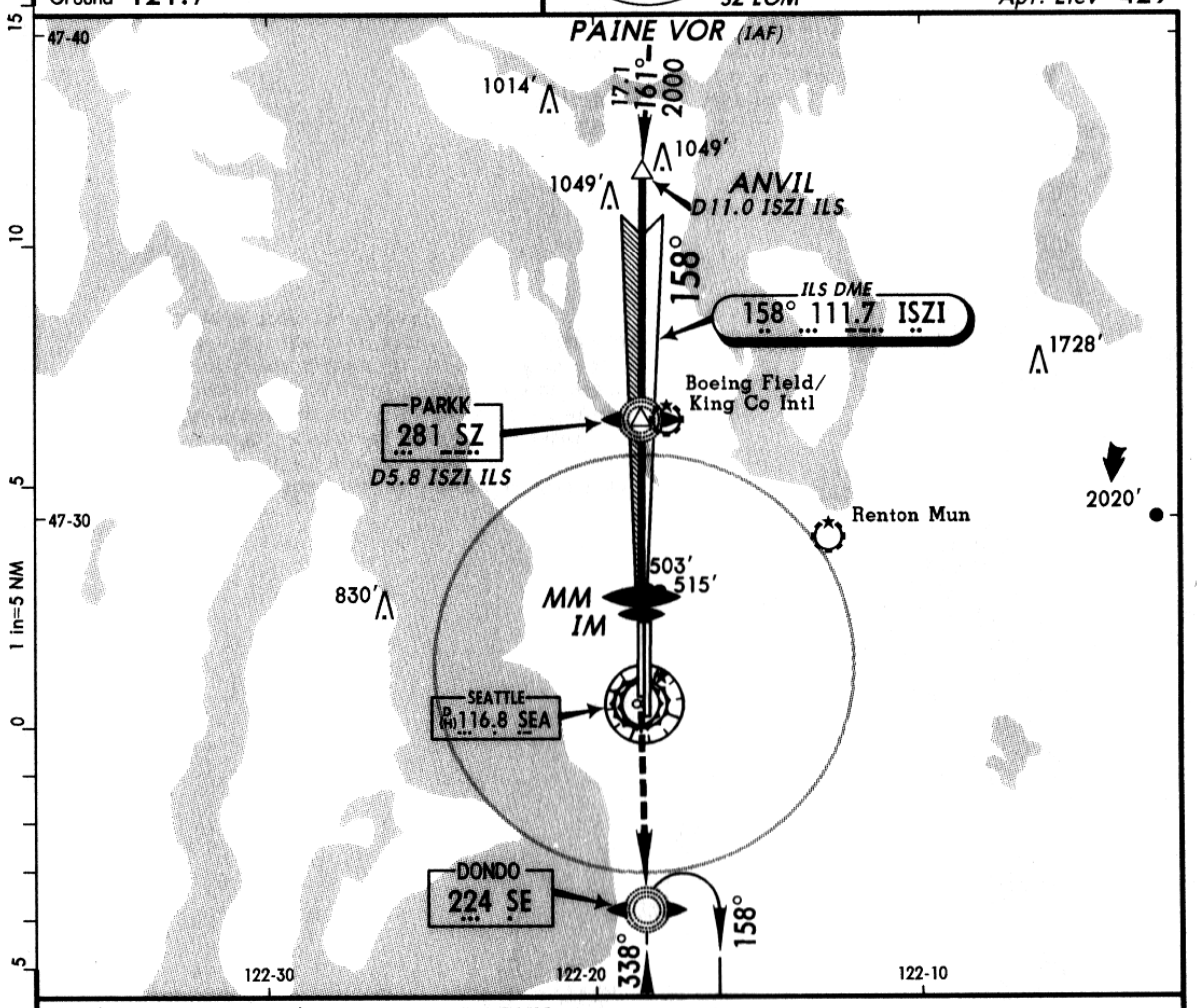
Special Aircrew & Acft Certification Required

LOC 111.7 ISZI

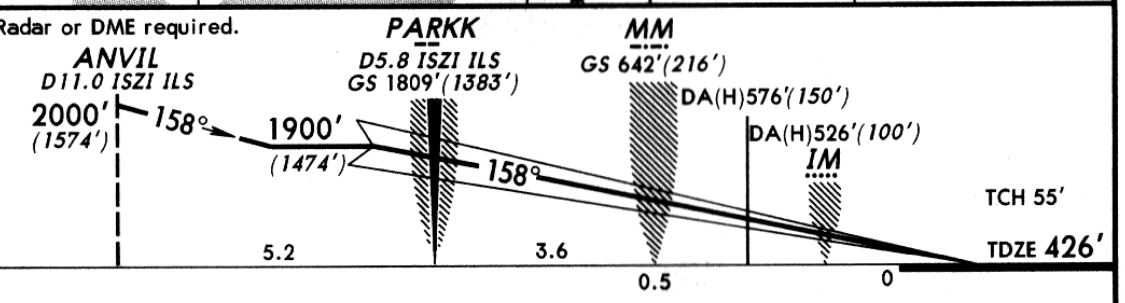
Apt. Elev 429′

ATIS 118.0
SEATTLE Approach (R) 123.9
SEATTLE Tower 119.9
Ground 121.7

MSA
SZ LOM
4500′ 180° 6200′ 360°



Radar or DME required.



MISSED APPROACH: Climb to 2000′ direct SE LOM and hold.

STRAIGHT-IN LANDING RWY 16R
CAT II ILS
RA NOT AUTH

DA(H) 526′(100′)	DA(H) 576′(150′)
RVR 12	RVR 16

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	485	539	647	755	862

AMEND 8

CHANGES: Missed approach.

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JEPPESEN FEB 16-90 (21-2)

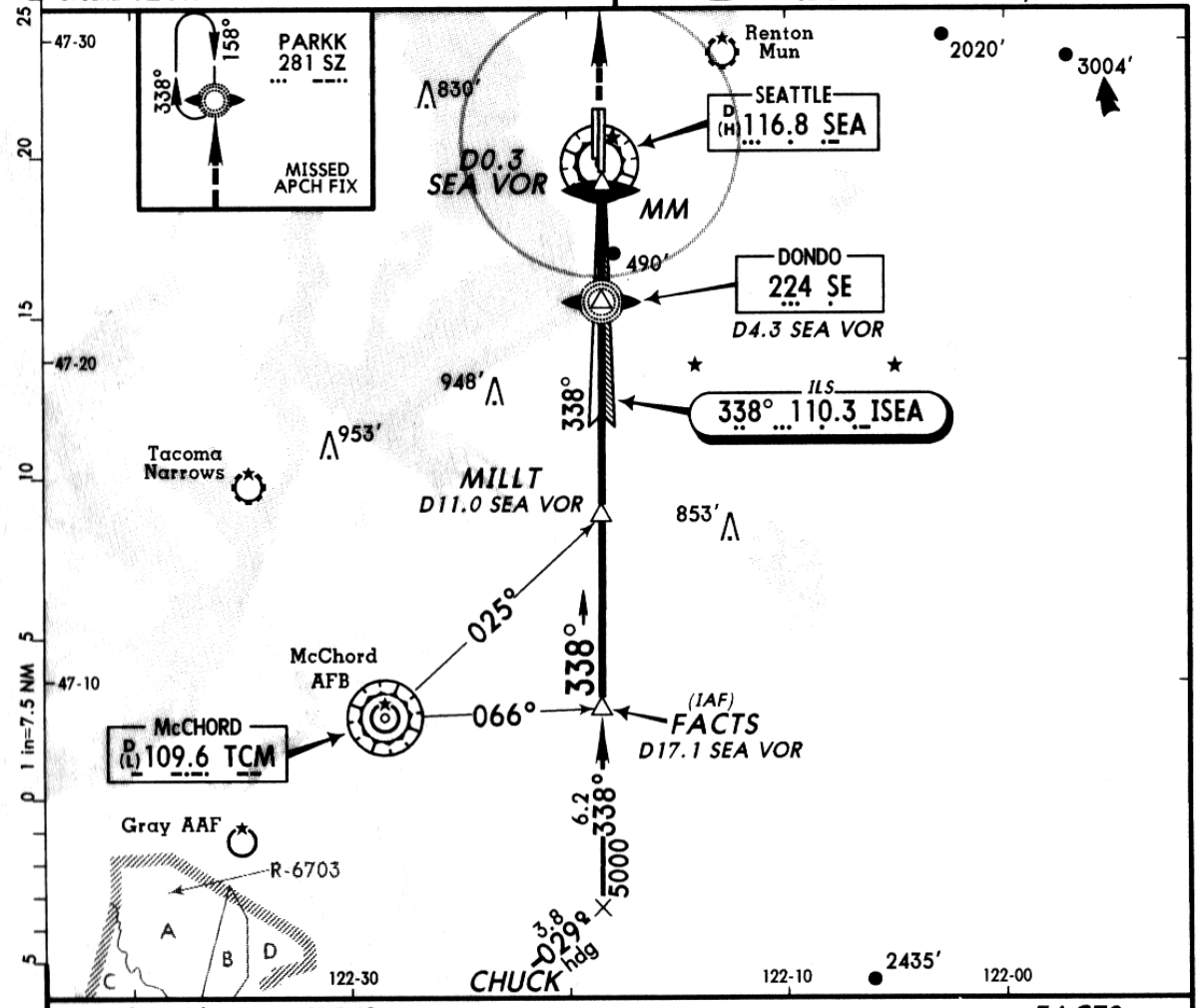
SEATTLE, WASH
-TACOMA INTL
ILS Rwy 34R

LOC 110.3 ISEA

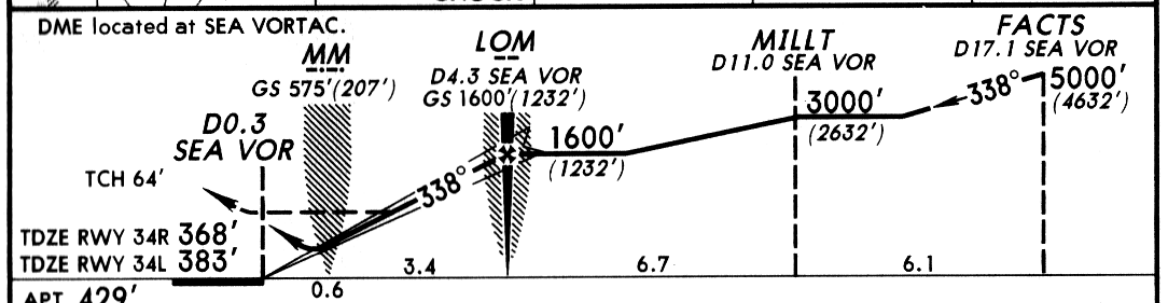
Apt. Elev 429′

ATIS 118.0
SEATTLE Approach (R) 123.9
SEATTLE Tower 119.9
Ground 121.7

MSA
SE LOM
3400′ 180° 6200′ 270° 7100′ 360°



DME located at SEA VORTAC.



MISSED APPROACH: Climb to 2100′ direct SZ LOM and hold.

STRAIGHT-IN LANDING RWY 34R

	ILS			LOC (GS out)			SIDESTEP LANDING RWY 34L	CIRCLE-TO-LAND	
	DA(H) 568′(200′)		DA(H) 618′(250′)	MDA(H) 740′(372′)			MDA(H) 760′(377′)	Max Kts	MDA(H)
	FULL	ALS out	MM out	MM out		ALS out			
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2		RVR 50 or 1	RVR 50 or 1	90	920′(491′)-1
B								120	
C							1 1/2	140	920′(491′)-1 1/2
D			RVR 40 or 3/4	RVR 40 or 3/4	RVR 50 or 1	RVR 60 or 1 1/4	2	165	980′(551′)-2

Gnd speed-Kts		70	90	100	120	140	160
GS	2.75°	345	444	493	592	690	789
MAP at D0.3 SEA or LOM to MAP	4.0	3:26	2:40	2:24	2:00	1:43	1:30

AMEND C

CHANGES: See other side.

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JEPPESEN MAR 2-90 (20-9) KSEA

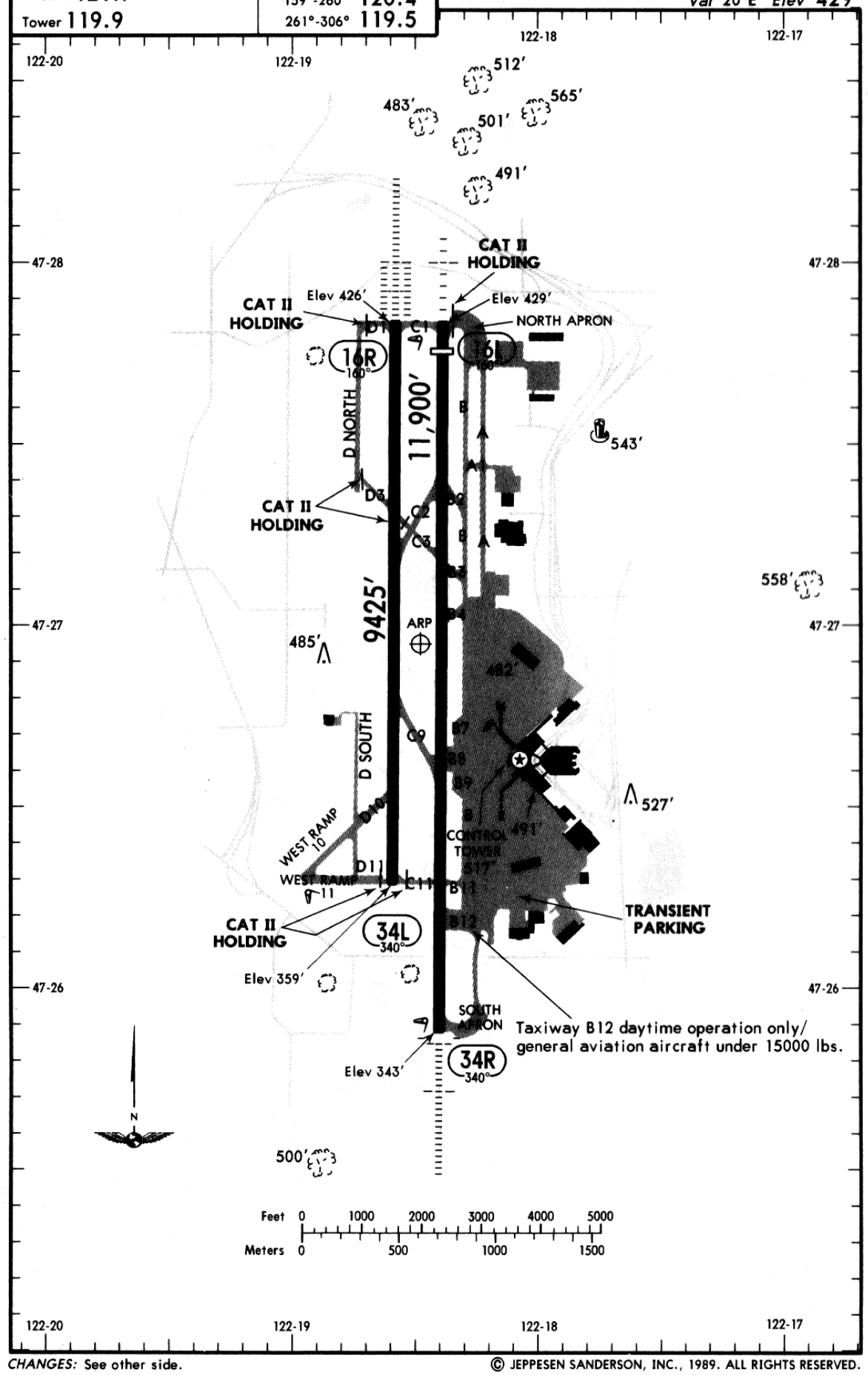
AIRPORT

SEATTLE, WASH -TACOMA INTL

SEA 116.8-On Airport N47 27.0 W122 18.5

Var 20°E *Elev* 429′

ATIS 118.0	SEATTLE Departure (R)
SEATTLE Clearance (Cpt) 128.0	307°-069° 123.9
Ground 121.7	070°-158° 119.2
Tower 119.9	159°-260° 120.4
	261°-306° 119.5



CHANGES: See other side.

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JEPPESEN MAR 17-89 (21-2)

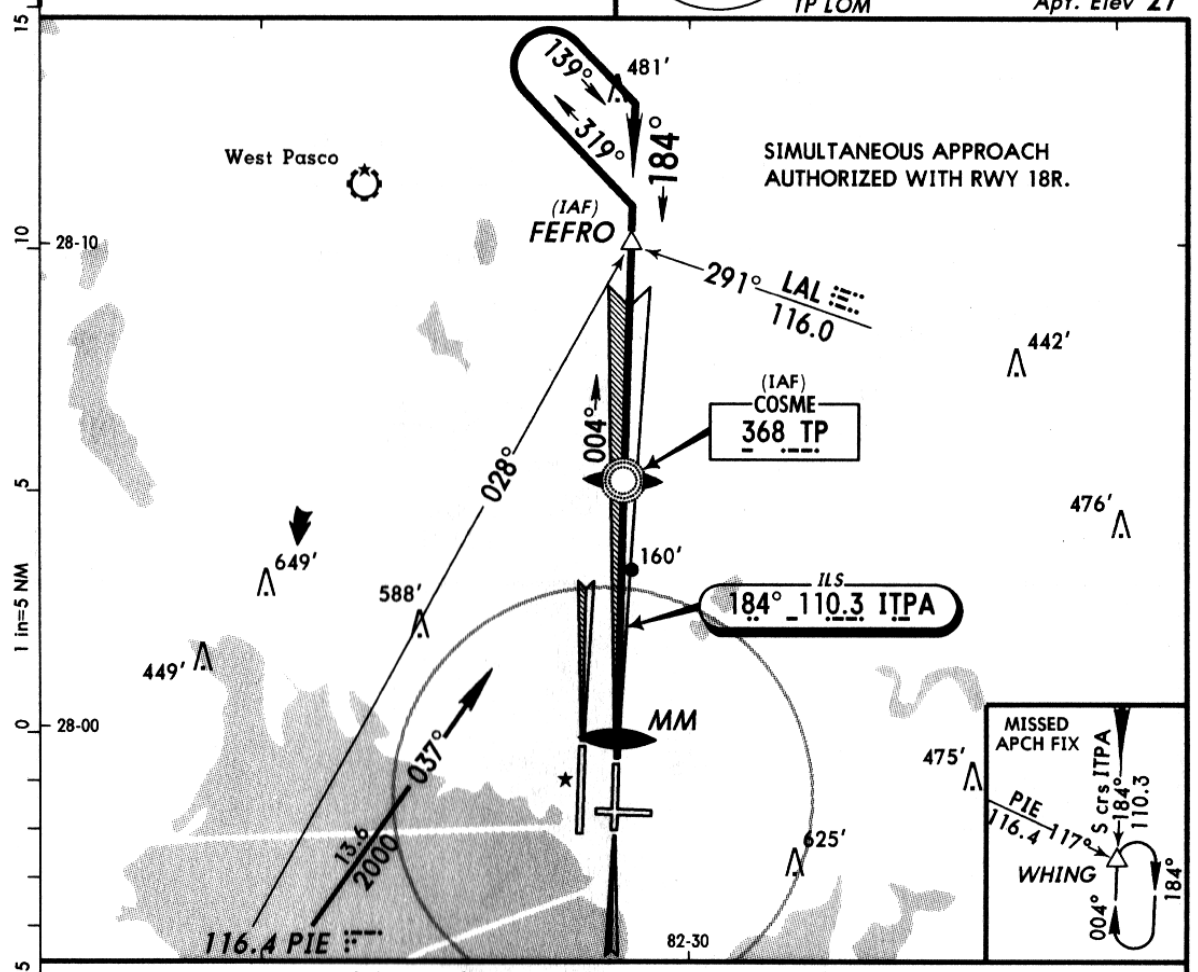
TAMPA, FLA
TAMPA INTL
ILS Rwy 18L

LOC 110.3 ITPA

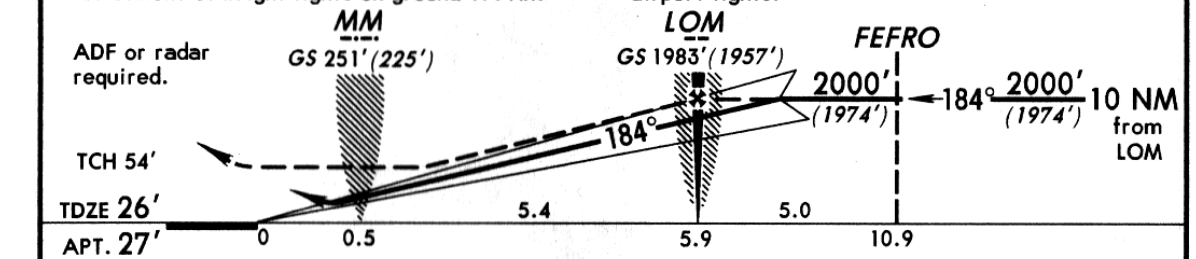
Apt. Elev 27′

ATIS 126.45	
TAMPA Approach (R) 118.5	
TAMPA Tower 119.5	
Ground 121.7	

2600′ *MSA TP LOM*



CAUTION: In minimum visibility conditions, reflections of bright lights on ground 1.4 NM north of rwy 18L threshold may be confused with airport lights.



MISSED APPROACH: Climb to 2600′ via ITPA LOC SOUTH course to WHING INT and hold.

STRAIGHT-IN LANDING RWY 18L

	ILS			LOC (GS out)			CIRCLE-TO-LAND
	DH 226′(200′)		DH 276′(250′)	MDA 420′(394′)			MDA
	FULL	RAIL or ALS out	MM out		RAIL out	ALS out	
A	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	A 560′(533′)-1
B							B
C							C 560′(533′)-1½
D			RVR 40 or ¾	RVR 40 or ¾	RVR 60 or 1¼		D 580′(553′)-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	541	649	757	865
LOM to MAP	5.9	5:03	3:56	3:32	2:57	2:32	2:13

AMEND 37

CHANGES: Profile note deleted, LOC (GS out) MM out column removed.

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JEPPESEN MAR 17-89 (21-3)

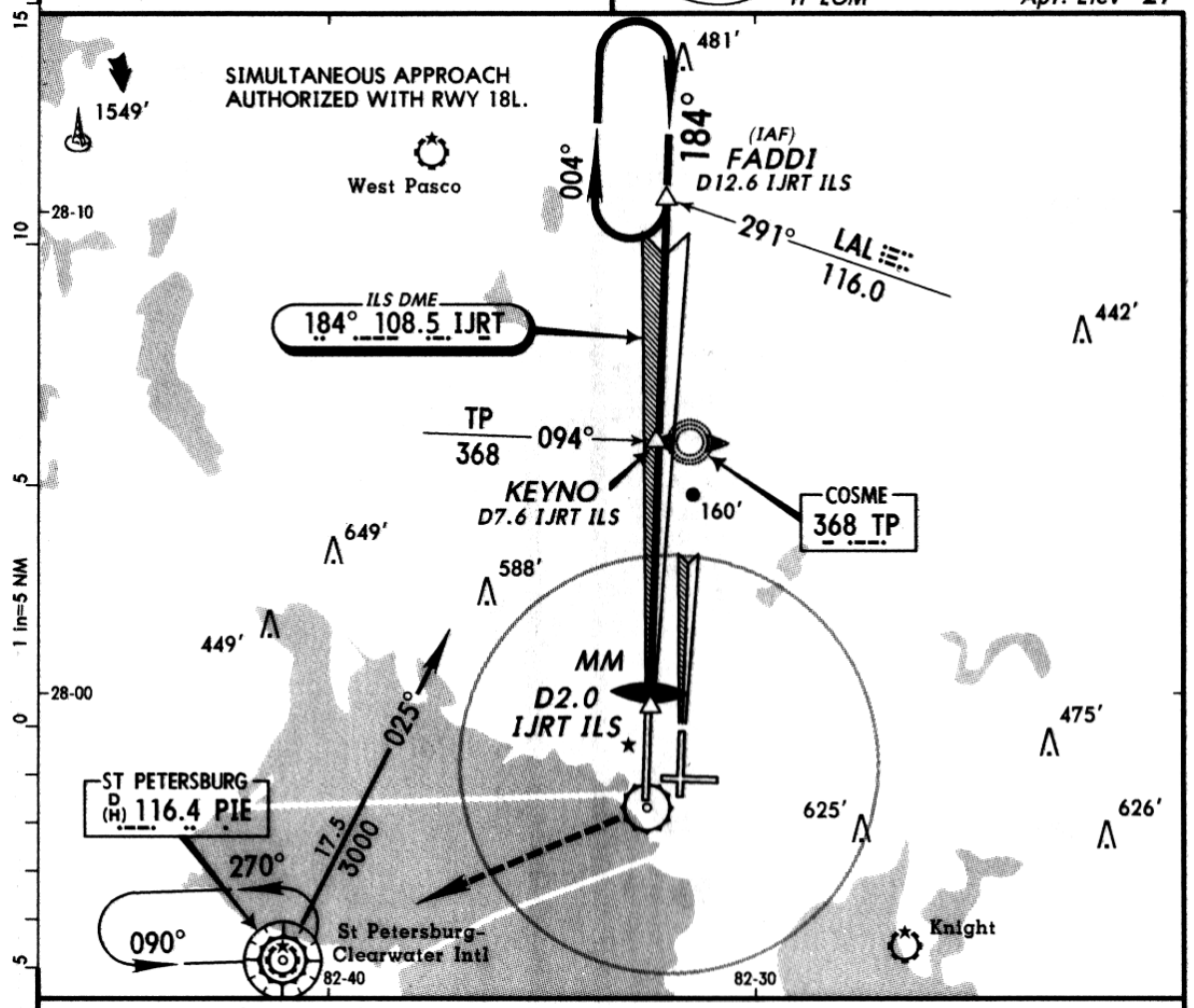
TAMPA, FLA
TAMPA INTL
ILS Rwy 18R

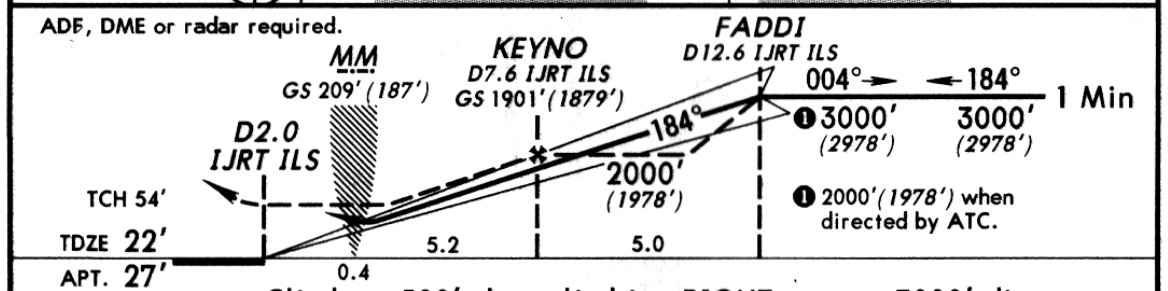
LOC 108.5 IJRT

ATIS 126.45
TAMPA Approach (R) 118.5
TAMPA Tower 119.5
Ground 121.7

2600' MSA TP LOM

Apt. Elev 27'





MISSED APPROACH: Climb to 500' then climbing RIGHT turn to 3000' direct PIE VOR and hold.

STRAIGHT-IN LANDING RWY 18R	ILS			LOC (GS out)			CIRCLE-TO-LAND
	DH 222' (200')		DH 272' (250')	MDA 420' (398')			MDA
	FULL	RAIL or ALS out	MM out	MM out	RAIL out	ALS out	
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 24 or 1/2	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	A 560' (533')-1
B							B
C							C 560' (533')-1 1/2
D			RVR 40 or 3/4	RVR 40 or 3/4	RVR 50 or 1	RVR 60 or 1 1/4	D 580' (553')-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
MAP at D2.0 or KEYNO to MAP	5.6	4:48	3:44	3:22	2:48	2:24	2:06

AMEND 2

CHANGES: See other side.

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JEPPESEN OCT 14-88 (21-1A)

TAMPA, FLA
TAMPA INTL
ILS Rwy 36L CAT II & III

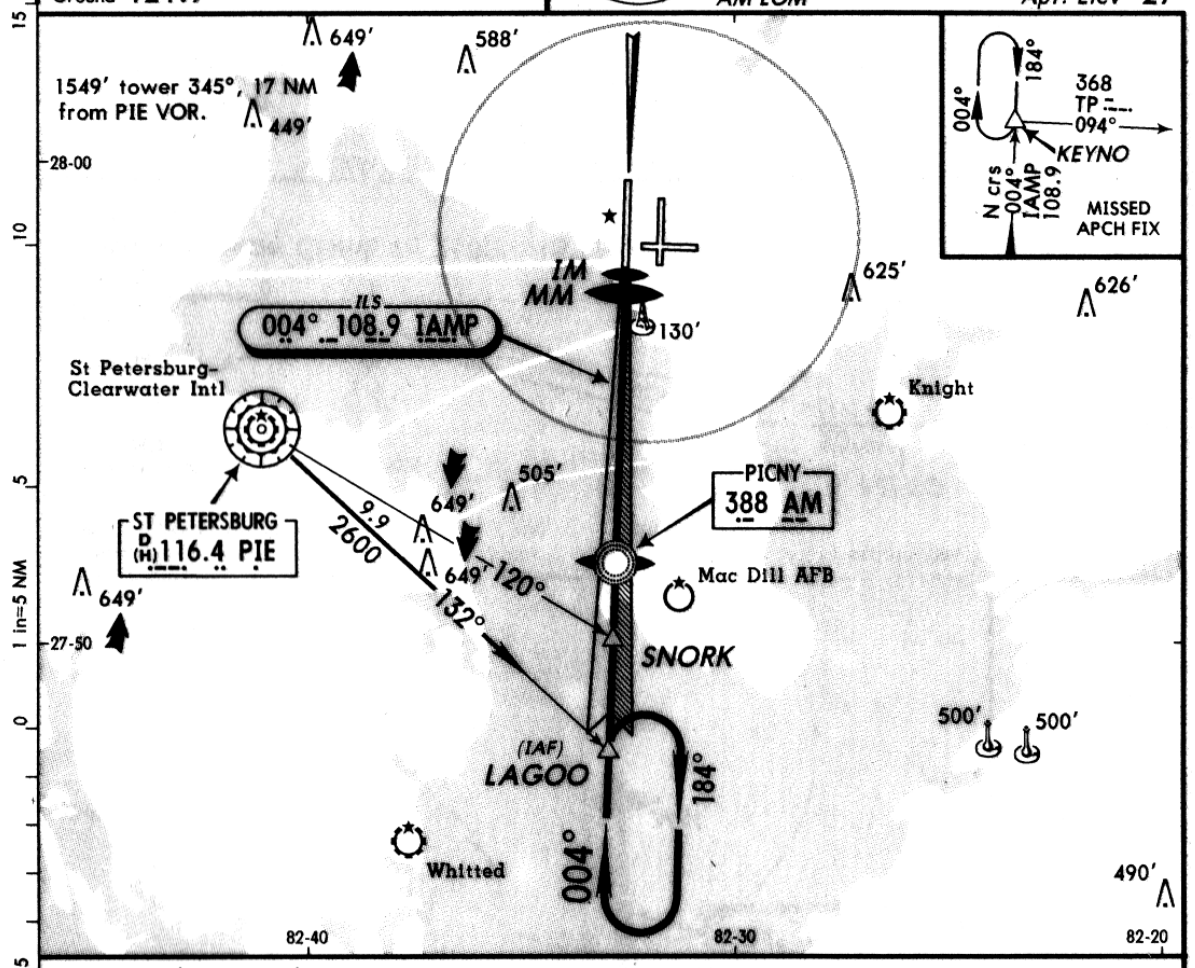
Special Aircrew & Acft Certification Required

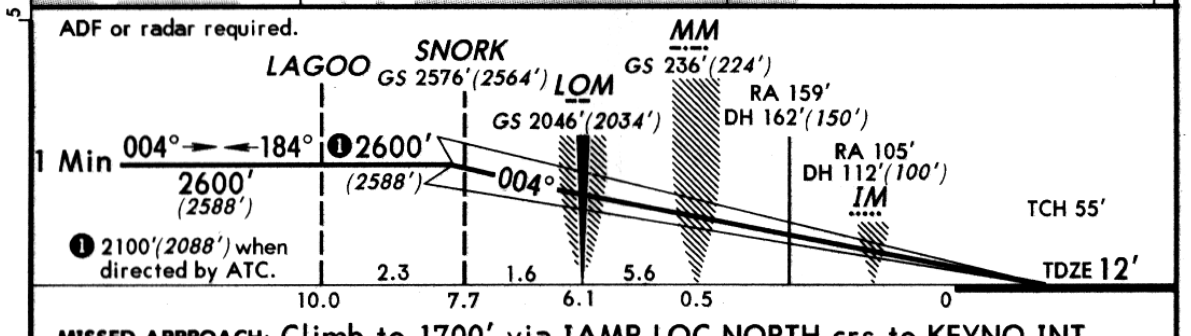
LOC 108.9 IAMP

ATIS 126.45
TAMPA Approach (R) 118.5
TAMPA Tower 119.5
Ground 121.7

2600' MSA AM LOM

Apt. Elev 27'





MISSED APPROACH: Climb to 1700' via IAMP LOC NORTH crs to KEYNO INT and hold.

STRAIGHT-IN LANDING RWY 36L	CAT IIIA ILS	CAT II ILS	
		RA 105' DH 112' (100')	RA 159' DH 162' (150')
	RVR 7	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	379	487	541	649	757	865

AMEND 14

CHANGES: See other side.

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JEPPESEN OCT 14-88 (21-4)

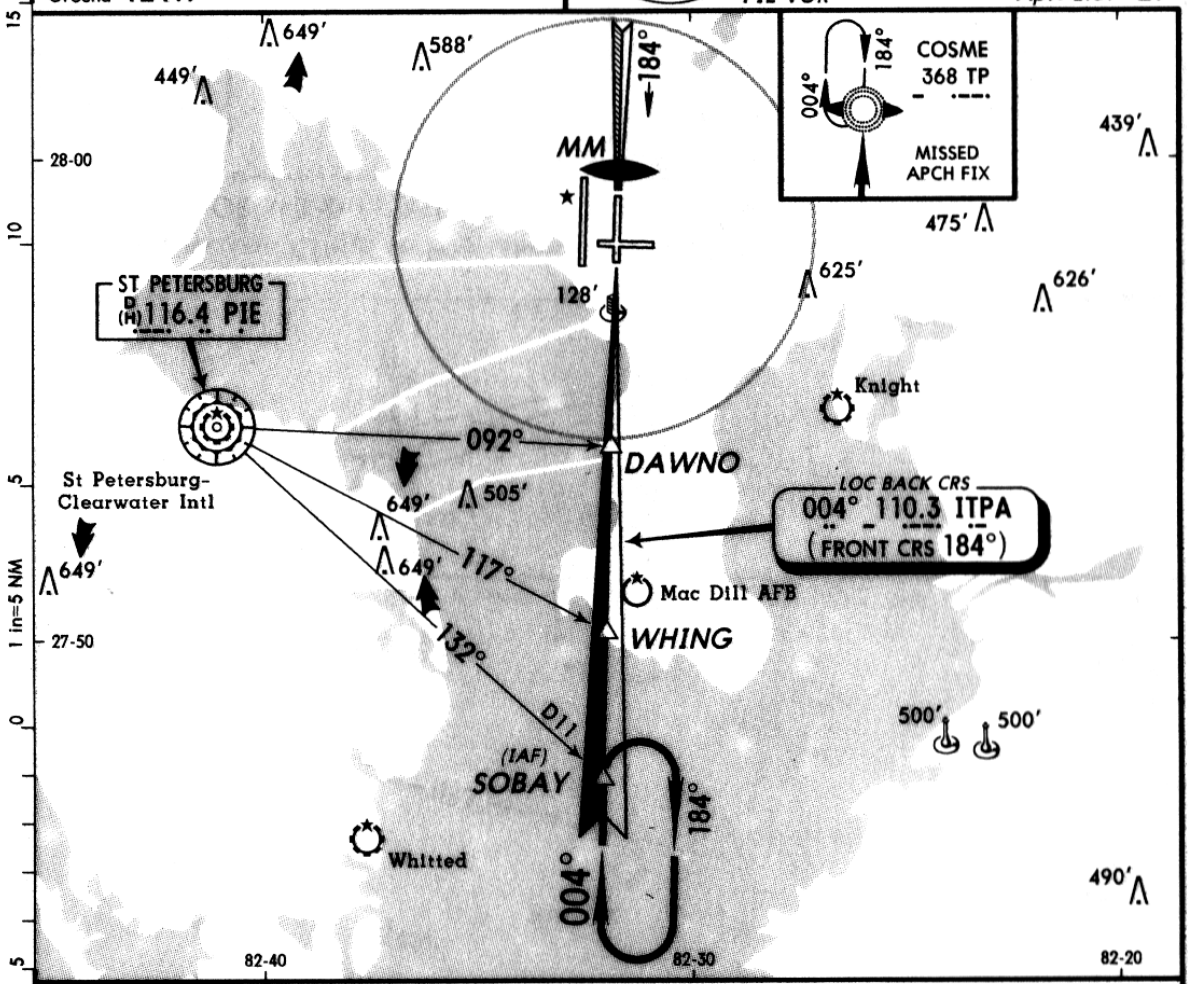
TAMPA, FLA
TAMPA INTL
LOC (BACK CRS) Rwy 36R

LOC 110.3 ITPA

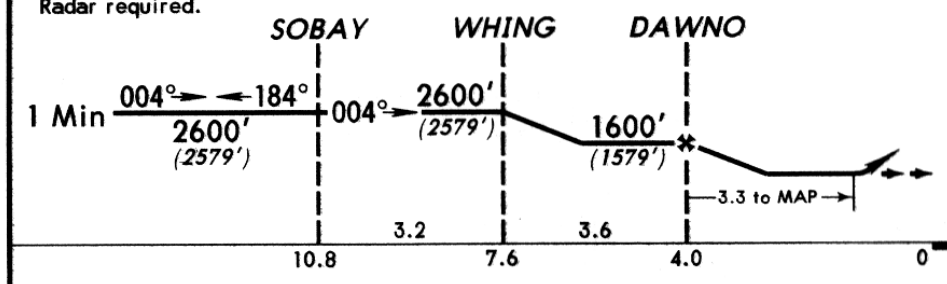
ATIS 126.45
TAMPA Approach (R) 118.5
TAMPA Tower 119.5
Ground 121.7

MSA
PIE VOR
130° 2600' 040° 1700'

Apt. Elev 27'



Radar required.



MISSED APPROACH: Climb to 1700' direct TP LOM and hold.

STRAIGHT-IN LANDING RWY 36R		CIRCLE-TO-LAND	
MDA 380' (359')		MDA	
A	1	A	560' (533') - 1
B		B	
C		C	560' (533') - 1½
D	1¼	D	580' (553') - 2

Gnd speed-Kts	70	90	100	120	140	160
DAWNO to MAP 3.3	2:50	2:12	1:59	1:39	1:25	1:14

AMEND 19

CHANGES: Minimums.

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JEPPESEN OCT 14-88 (20-9)

KTPA

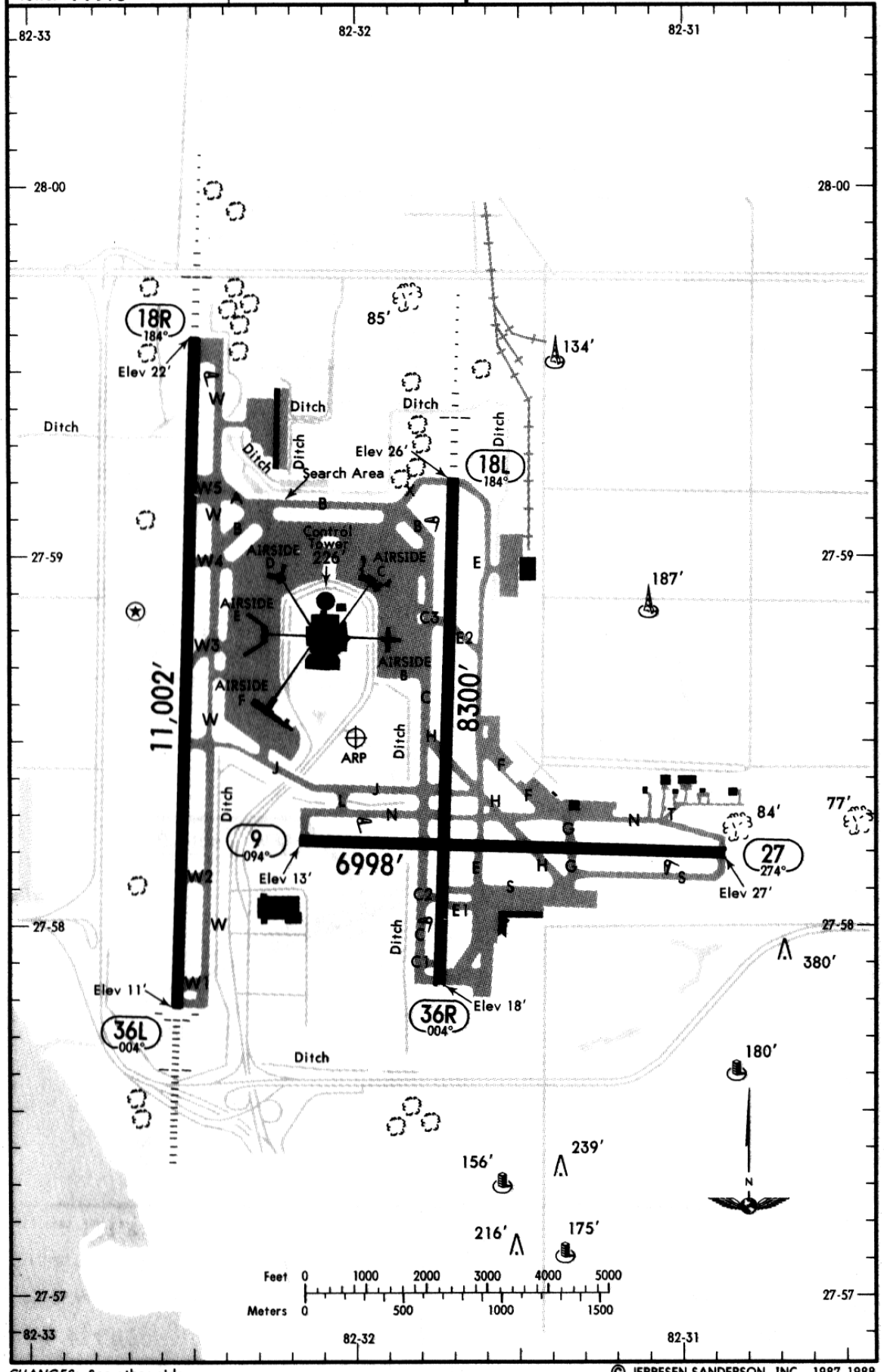
AIRPORT

TAMPA, FLA
TAMPA INTL

062.2°/9.0 From PIE 116.4 N27 58.5 W082 32.0
Var 02°W Elev 27'

ATIS 126.45
TAMPA Clearance 133.6
Ground 121.7
Tower 119.5

TAMPA Departure (R)
001°-090° 126.0
091°-180° 134.25
181°-360° 118.8
VOT 111.0



CHANGES: See other side.

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JEPPESEN AUG 18-89 (21-1A) Eff Aug 24

WASHINGTON, DC (VA)

DULLES INTL

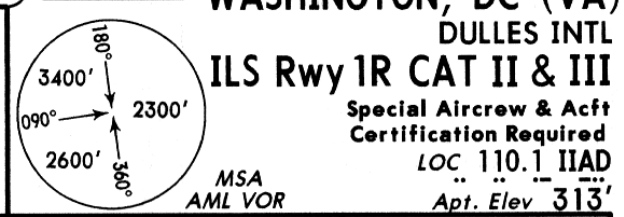
ILS Rwy 1R CAT II & III

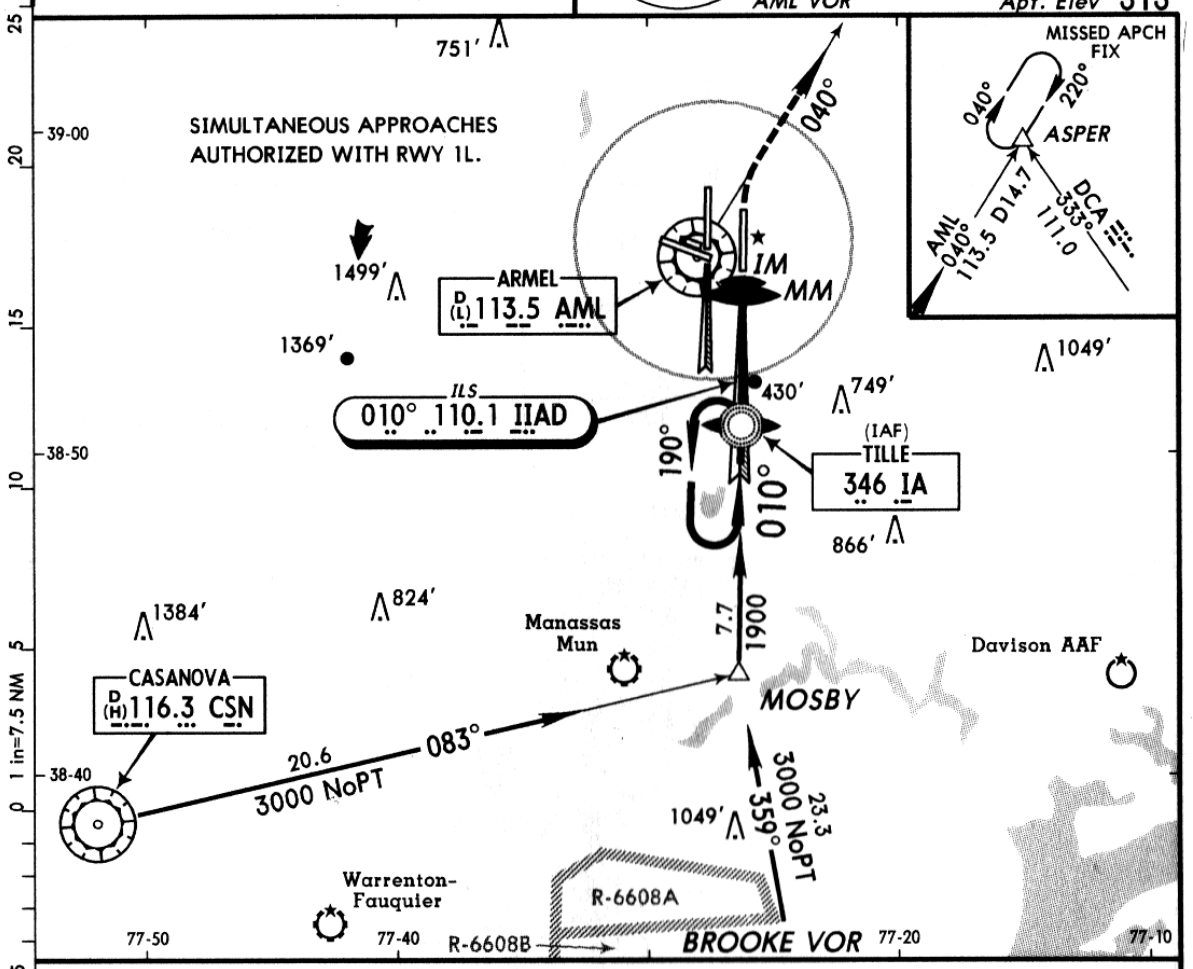
Special Aircrew & Acft Certification Required

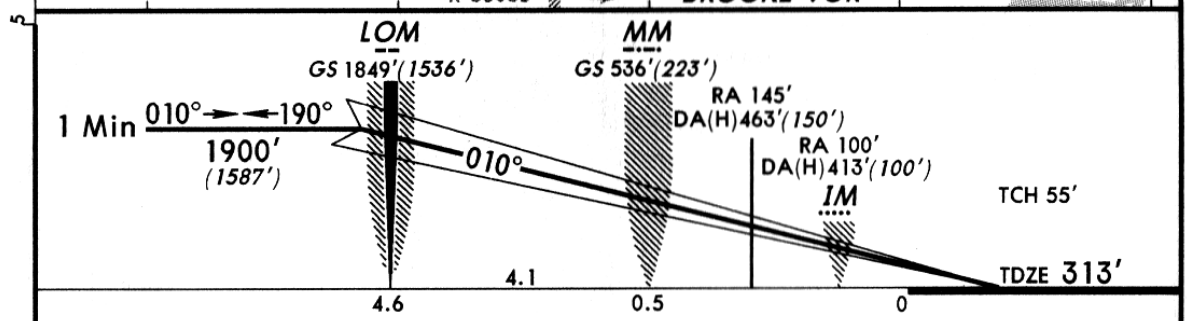
LOC 110.1 IIAD

Apt. Elev 313′

ATIS 134.85
DULLES Approach (R) 120.45
DULLES Tower 120.1
Ground 121.9







MISSED APPROACH: Climb to 800′ then climbing RIGHT turn to 3000′ outbound via AML VOR R-040 to ASPER INT/AML D14.7 and hold.

STRAIGHT-IN LANDING RWY 1R

CAT IIIC ILS	CAT IIIB ILS	CAT IIIA ILS	CAT II ILS RA 100′ DA(H) 413′(100′)	CAT II ILS RA 145′ DA(H) 463′(150′)
NA	RVR 6	RVR 7	RVR 12	RVR 16

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	377	485	538	646	754	861

AMEND 21

CHANGES: Procedure.

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JEPPESEN AUG 18-89 (21-5) Eff Aug 24

WASHINGTON, DC (VA)

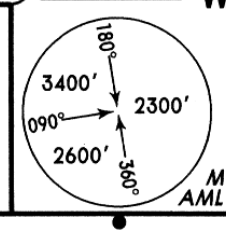
DULLES INTL

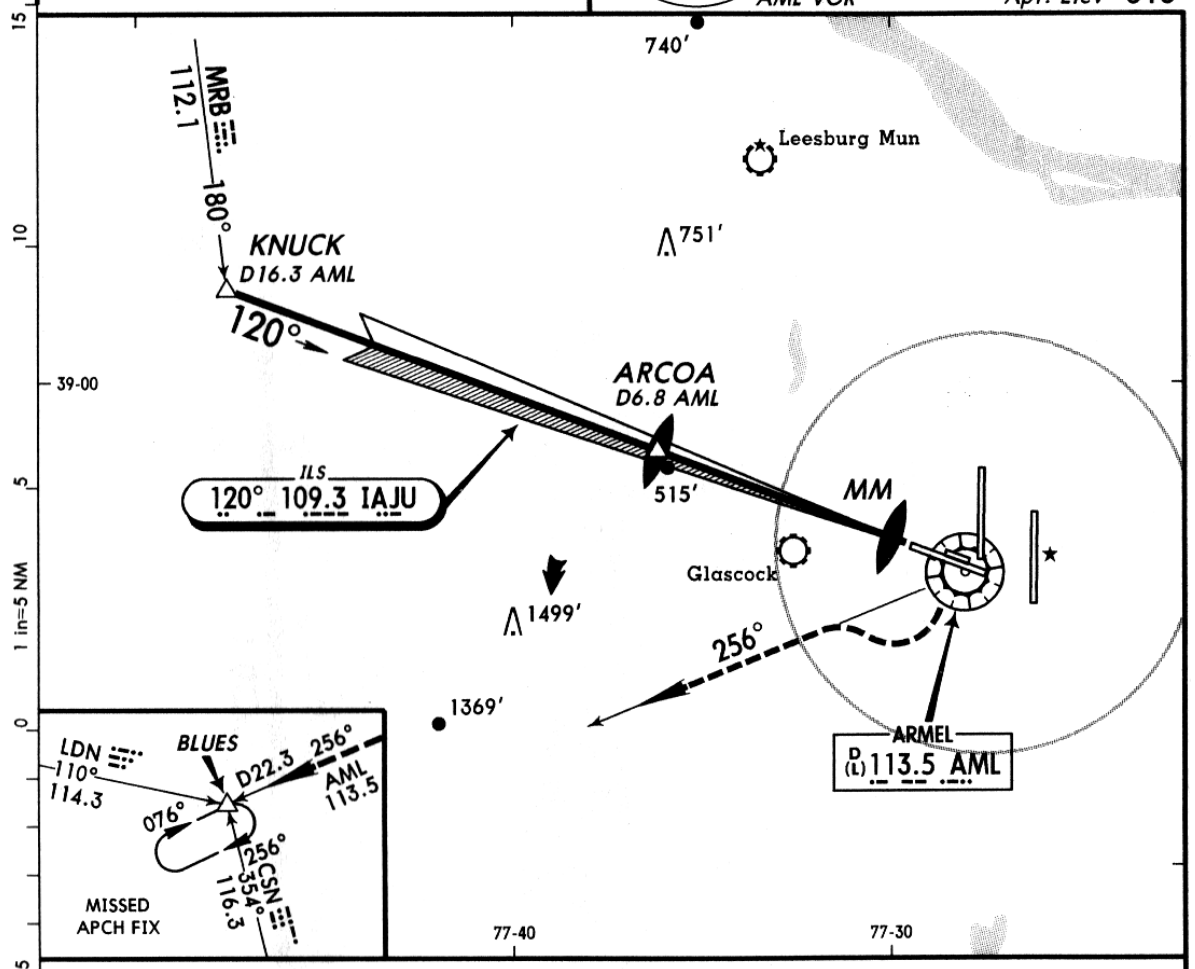
ILS-1 Rwy 12

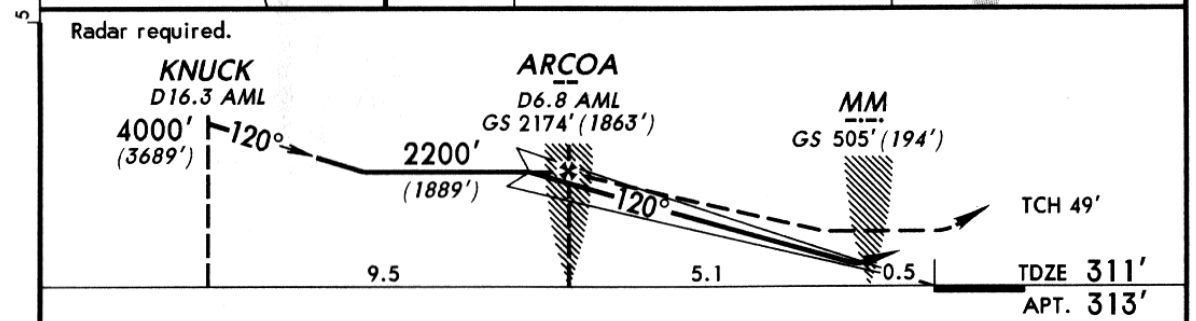
LOC 109.3 IAJU

Apt. Elev 313′

ATIS 134.85
DULLES Approach (R) 120.45
DULLES Tower 120.1
Ground 121.9







MISSED APPROACH: Climbing RIGHT turn to 4000′ outbound via AML VOR R-256 to BLUES INT and hold.

STRAIGHT-IN LANDING RWY 12

	ILS DA(H) 511′(200′) FULL	ILS DA(H) 511′(200′) RAIL or ALS out	ILS DA(H) 561′(250′) MM out	LOC (GS out) MDA(H) 780′(469′)			CIRCLE-TO-LAND Max Kts	CIRCLE-TO-LAND MDA(H)
					RAIL out	ALS out		
A	1/2	3/4	1/2	1/2	3/4	1	90	840′(527′)-1
B							120	
C				3/4	1 1/4		140	840′(527′)-1 1/2
D			3/4	1	1 1/2		165	880′(567′)-2

Gnd speed-Kts		70	90	100	120	140	160
GS	3.00°	378	486	540	648	756	864
ARCOA to MAP	5.6	4:48	3:44	3:22	2:48	2:24	2:06

AMEND 4

CHANGES: Procedure.

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JEPPESEN AUG 18-89 (21-4) Eff Aug 24

WASHINGTON, DC (VA)

DULLES INTL

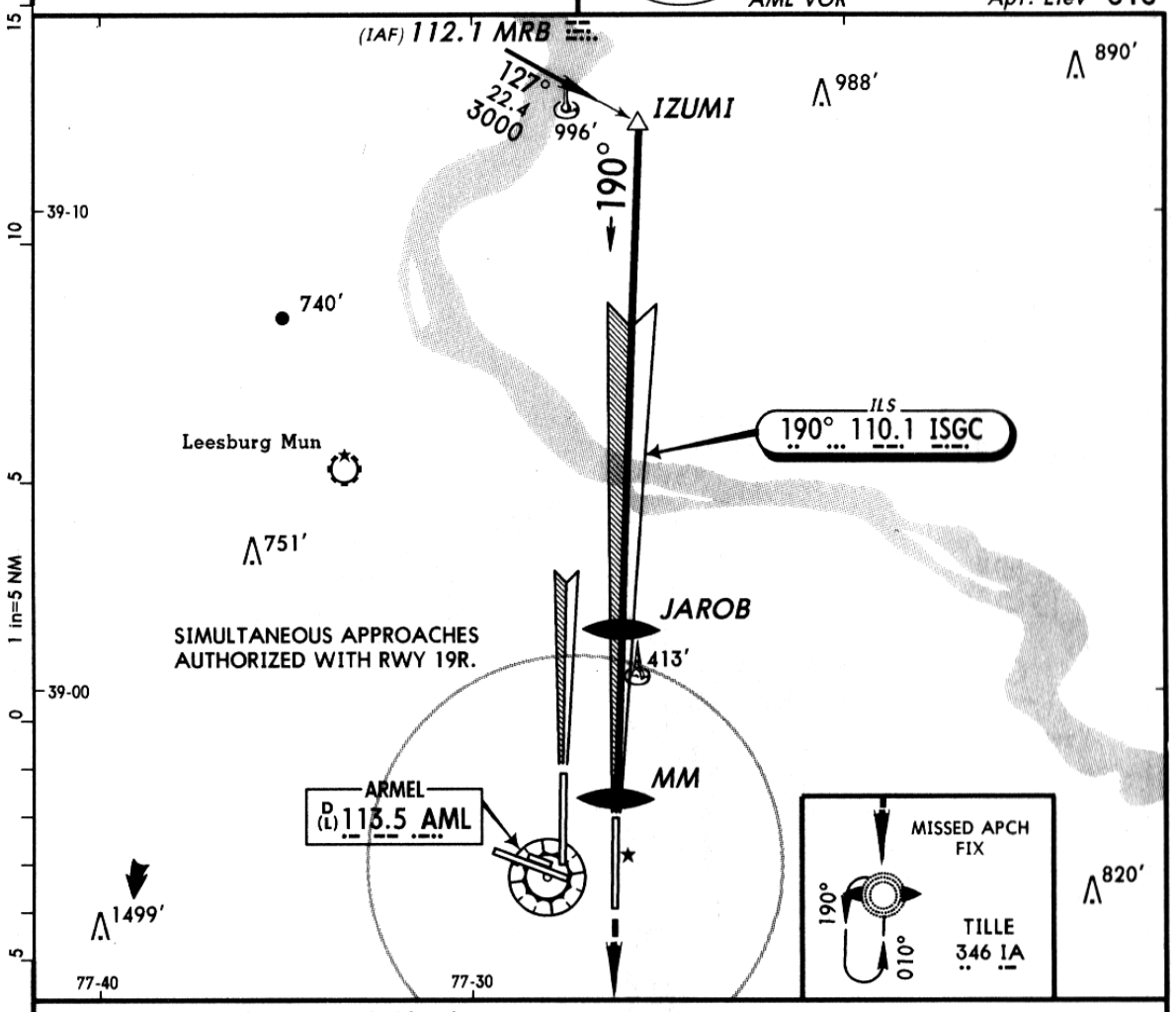
ILS-1 Rwy 19L

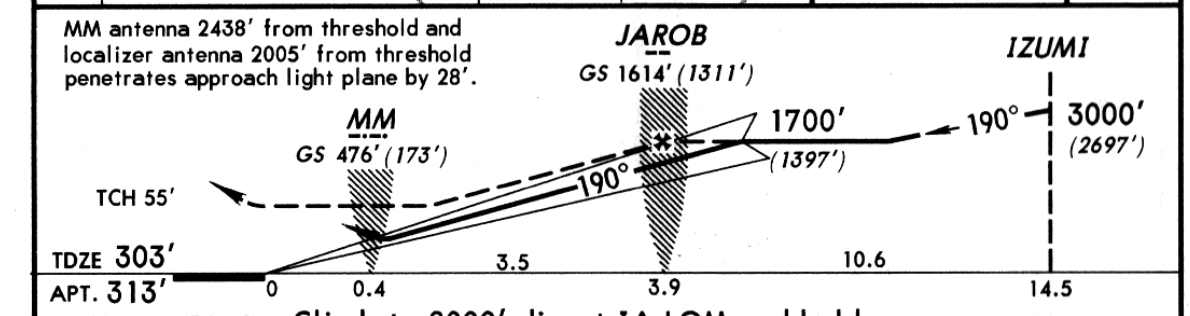
LOC 110.1 ISGC

Apt. Elev 313′

ATIS 134.85
DULLES Approach (R) 120.45
DULLES Tower 120.1
Ground 121.9

MSA
AML VOR
180° 3400′ 2300′ 090° 2600′ 360°





MISSED APPROACH: Climb to 2000′ direct IA LOM and hold.

STRAIGHT-IN LANDING RWY 19L

	ILS DA(H) 503′(200′) FULL	ILS RAIL or ALS out	LOC (GS out) DA(H) 553′(250′) MM out	LOC (GS out) MDA(H) 680′(377′)	RAIL out	ALS out	Max Kts	CIRCLE-TO-LAND MDA(H)
A	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	90	840′(527′)-1
B							120	
C							140	840′(527′)-1½
D			RVR 40 or ¾	RVR 40 or ¾	RVR 60 or 1¼		165	880′(567′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	376	483	537	644	751	859
JAROB to MAP 3.9	3:21	2:36	2:20	1:57	1:40	1:28

AMEND 8

CHANGES: Procedure.

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JEPPESEN AUG 18-89 (21-3) Eff Aug 24

WASHINGTON, DC (VA)

DULLES INTL

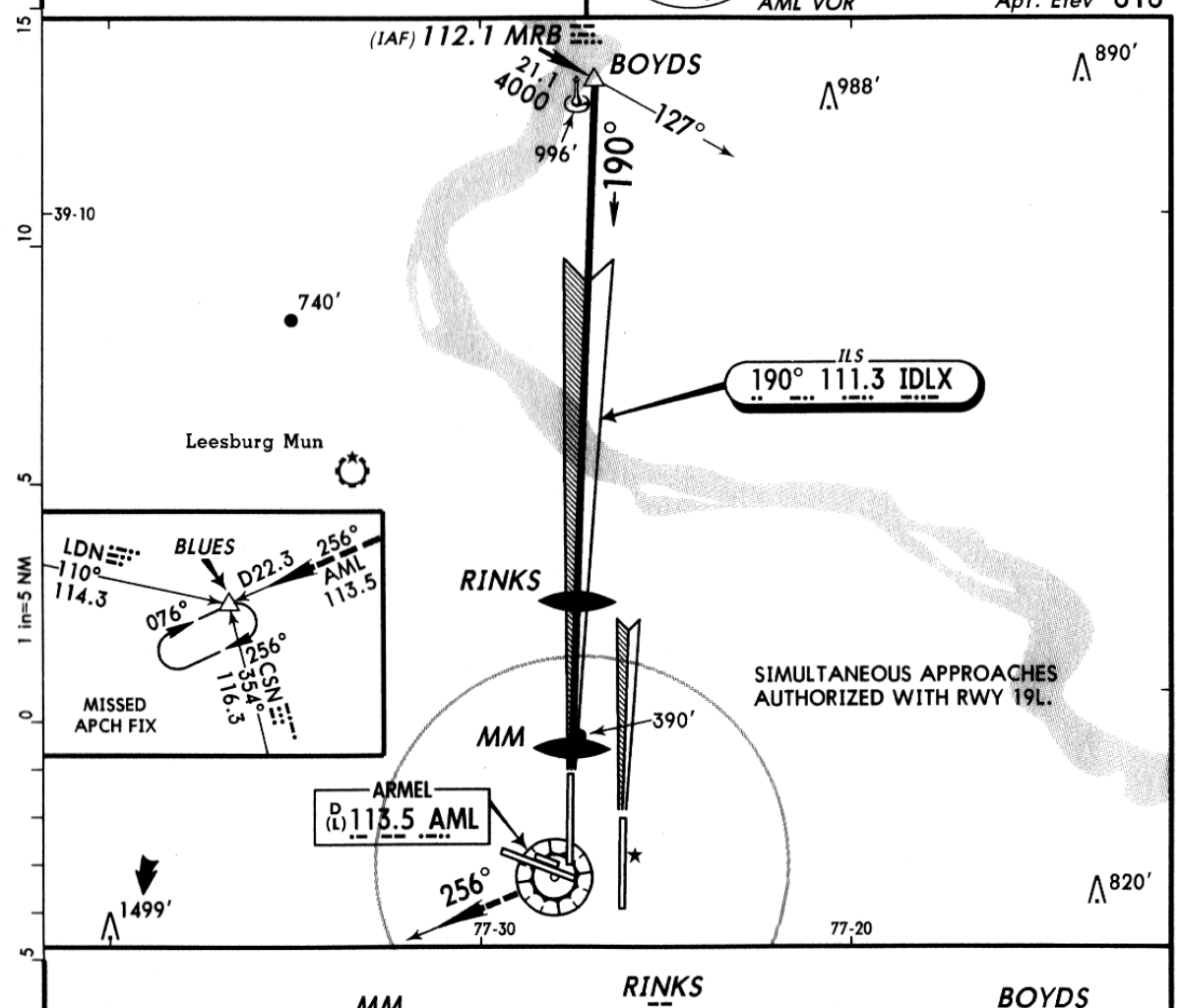
ILS-1 Rwy 19R

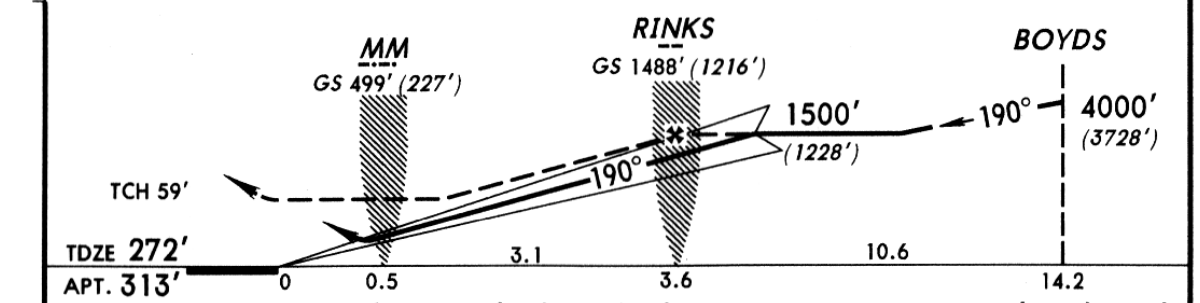
LOC 111.3 IDLX

Apt. Elev 313′

ATIS 134.85
DULLES Approach (R) 120.45
DULLES Tower 120.1
Ground 121.9

MSA
AML VOR
180° 3400′ 2300′ 090° 2600′ 360°





MISSED APPROACH: Climb to 800′, then climbing RIGHT turn to 4000′ outbound via AML VOR R-256 to BLUES INT and hold.

STRAIGHT-IN LANDING RWY 19R

	ILS DA(H) 472′(200′) FULL	ILS TDZ or CL out	ILS RAIL or ALS out	LOC (GS out) DA(H) 522′(250′) MM out	LOC (GS out) MDA(H) 640′(368′)	RAIL out	ALS out	Max Kts	CIRCLE-TO-LAND MDA(H)
A	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	90	840′(527′)-1
B								120	
C								140	840′(527′)-1½
D				RVR 40 or ¾	RVR 40 or ¾	RVR 60 or 1¼		165	880′(567′)-2

Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	376	483	537	644	751	859
RINKS to MAP 3.6	3:05	2:24	2:10	1:48	1:33	1:21

AMEND 20

CHANGES: Procedure.

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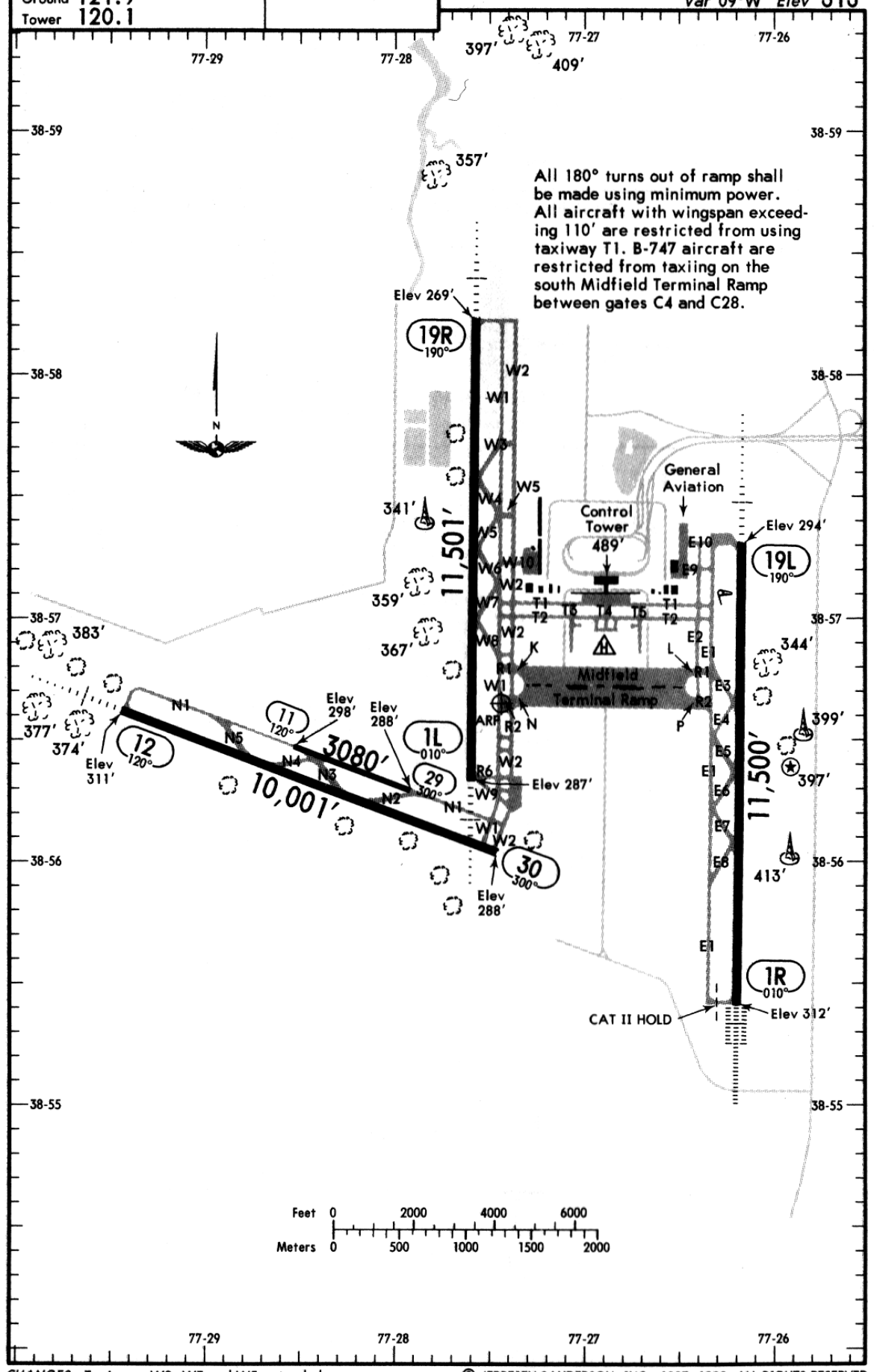
AIRPORT

KIAD WASHINGTON, DC (VA)
DULLES INTL

ATIS 134.85
DULLES Clearance (Cpt) 127.35
Midfield Ramp Control 129.55
Ground 121.9
Tower 120.1

DULLES Departure (R)
300°-120° 125.05
121°-299° 126.65

AML 113.5 - On Airport N38 56.7 W077 27.4
Var 09°W *Elev* 313′



CHANGES: Taxiways W2, W3 and W5 extended.

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